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Mariners Weather Log

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Mariners Weather Log

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FEATURES

DEPARTMENTS

Cover:
Tall ships and the Statue of Liberty were intertwined on the 4th as NOAA played its role behind the scenes. Story on page 145. Wide World Photo.

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through April 1, 1988.

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PORT EVERGLADES
AS A HURRICANE HAVEN

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Editor's Note: *This is the eighth in a series of articles evaluating the safety of ports as shelters from tropical cyclones. These are edited versions of studies that appear in the Hurricane Havens Handbook for the North Atlantic Ocean by Roger Turpin and Samson Brand, June 1982, Naval Environmental Prediction Research Facility, Monterey, CA. (to order see pg. 34 of the winter 1986 issue).*

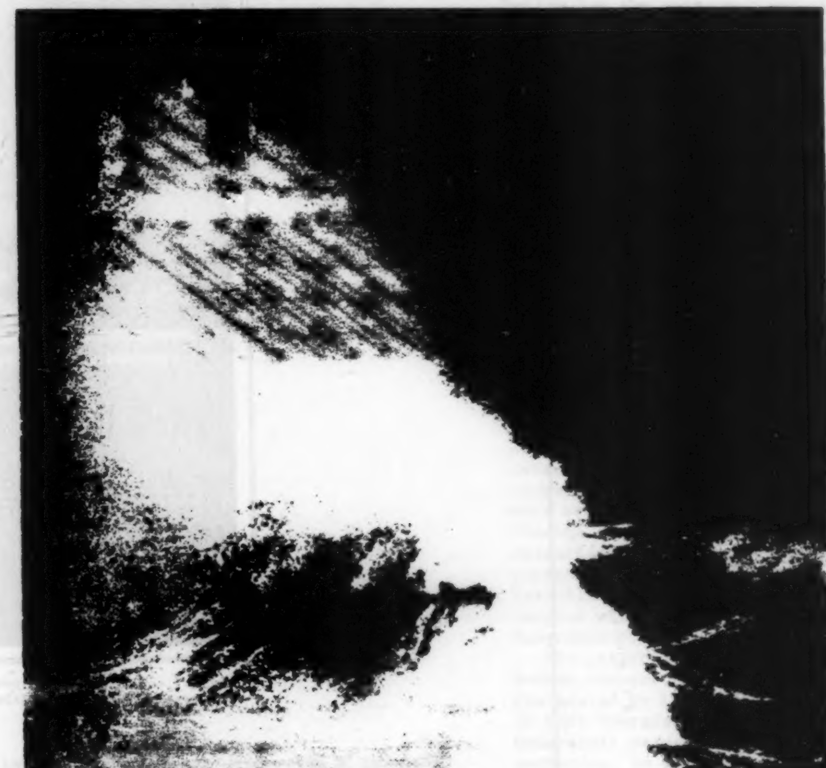


Figure 1.-- Waves from hurricane David (Sept. 1979) lash nearby Hillsboro Lighthouse.

No major U.S. port is more susceptible to hurricanes than Port Everglades, Florida. In addition it is a poor hurricane haven since it lacks sheltered facilities and is vulnerable to storm surge and high winds. Evasion at sea is recommended for all seaworthy deep-draft vessels when the port is threatened by an intense tropical storm or hurricane (fig.1).

during the 109 year period from 1871-1979, 156 tropical cyclones passed within the 180 mile threat radius for ...

Port Everglades

The Setting

Port Everglades, the largest seaport along Florida's lower east coast, lies about 25 mi north of Miami and some 2 mi from the major Atlantic shipping lanes. It is also located on the Atlantic Intracoastal Waterway just south of the "Venice of America" -- Fort Lauderdale. This major winter resort area, with its natural waterways and man-made canals, harbors thousands of small craft as well as serving as home to hundreds of fishing boats (fig. 2).

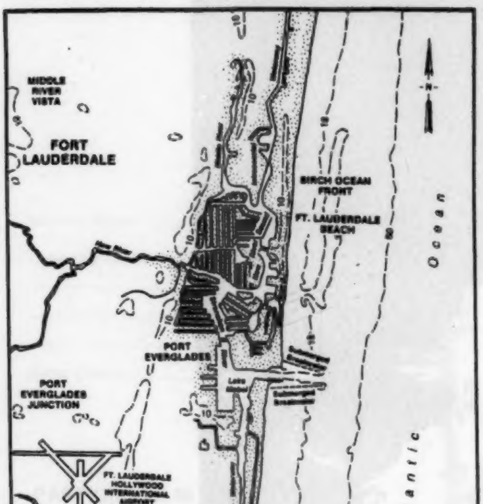
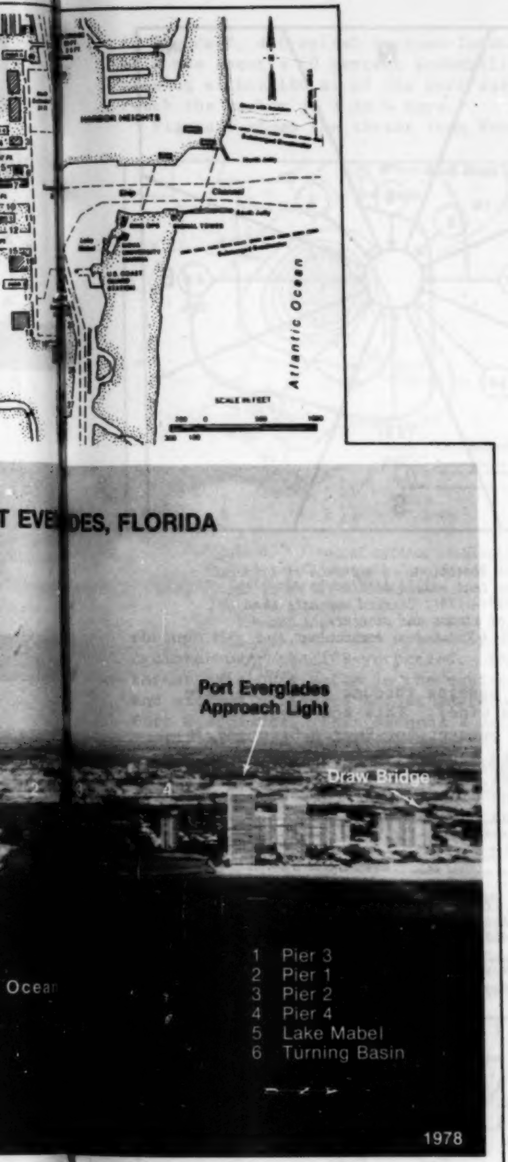


Figure 2.-- Port Everglades and surrounding communities (heights in ft above mean high water and soundings in ft below mean low water).

Figure 3.-- Closeup of the port. Alongside depths may vary 1-2 ft from depths shown.

The port's deepwater entrance is a dredged, east-west Channel that extends from the ocean through a barrier beach into a large turning basin in Lake Mabel (fig. 3). This entrance, also providing ocean access to small craft, is protected by two rock jetty systems. The Inner North and South Jetties are complemented by two outer, submerged, rock breakwaters some 10 to 15



ft below mean low water (MLW). These outer breakwaters, about 100 ft wide, are some 2500 ft apart near shore, converging to 1200 ft at their seaward ends. A Federal project provides for a 500 ft wide, 45 ft deep entrance channel that converges at the entrance jetties to 300 ft in width and 40 ft in depth (MLW). The channel leads to a 42-ft deep turning basin and the 38-ft (MLW) depth in the inner harbor makes it Florida's deepest. Notice to Mariners and the latest navigational charts provide information on controlling depths. The Intracoastal Waterway passes through the port's turning basin and a bascule bridge with a 25-ft vertical clearance spans the waterway at the northern terminus of the port.

Port Everglades offers little protection from heavy weather, although the facilities at the northern and southern extensions of the turning basin are most sheltered. Some wind protection is offered by man-made structures on the piers while wave action in these areas is limited to refracted ocean waves and limited-fetch wind waves. In general, the low elevation of the surrounding terrain and the proximity to the ocean makes the port vulnerable to all strong winds; particularly those from the northeast through southeast.

The narrow channel and two jetty system helps protect the port from the ocean waves. Large waves from the east can move through the channel but some energy would be lost when they felt bottom, at the entrance, and when diffraction occurred inside the harbor. Wind wave action within the harbor is restricted due to a lack of fetch. Using a maximum of one mile north-south fetch and an average depth of 40 ft, it can be calculated that 35-kn winds would generate, 2-to 3-ft wind waves, 75-kn winds would generate 4-ft winds waves, and 100-kn winds would generate 5-ft wind waves (U.S. Army Corps of Engineers, 1977). Adding a tidal surge height of 10 ft would increase the 100-kn wind waves to 5.5 ft. East-west fetch is limited to less than one-half mile except for those piers directly opposite the channel opening; these could be subjected to heavy wave action due to the unrestricted over-water ocean fetch. Even wind waves from the east are restricted to 13 to 14 ft due to the reduced bottom.

The mean tide range at the entrance of Port Everglades is 2.5 ft above MLW. The average tidal current in the entrance is about 1 kn. In June 1975, it was reported that flood and ebb currents attained velocities of 3kn and 4kn respectively; these may have been associated with tropical depression Amy just off the Florida coast. Current swirls of varying characteristics, often encountered in the turning basin, can make ship handling difficult. Prevailing winds from the southeast and east coupled with a rising tide make the most hazardous conditions.

The prescribed anchorage is outside the harbor and north of the channel (within an area designated by the harbor master); just northeast of Port Everglades Approach Lighted Buoy 2. Deep-draft vessels should await the pilot before anchoring, to avoid damage to underwater cables south of the channel and the reefs to the north. Much of the area south of the channel is prohibited anchorage; the latest chart will provide information. Anchoring within the turning basin is prohibited except in an emergency. Anchoring offshore to ride out a storm is not recommended.

The Climatology

The frequency, direction of approach, speed of movement and intensity of past tropical cyclones, that have affected Port Everglades, provides insight into storm behavior and the potential threat to the harbor. An historical overview, however, is not a totally reliable guide to the impact of future storms.

For this study, any tropical cyclone approaching within 180 mi of Port Everglades is considered to represent a threat to the port. Tropical cyclones that affect Port Everglades are spawned primarily in the North Atlantic Ocean, east of the Lesser Antilles and in the Caribbean Sea. Port Everglades lies within or adjacent to preferred storm tracks for much of the hurricane season (Crutcher and Quayle, 1974). Its latitude (26.1°N) places the port in the zone (approximately 25°N to 35°N) of tropical cyclone recurvature, where a tropical cyclone is apt to slow and intensify.

The official hurricane season for the North Atlantic extends from June 1 to November 30, but tropical cyclones can occur at anytime; Port Everglades has recorded storms in February, May, and December. During the 109-year period from 1871-1979, 156 tropical cyclones passed within the 180 mi threat radius for Port Everglades; an average of 1.4 per year (fig. 4). The major

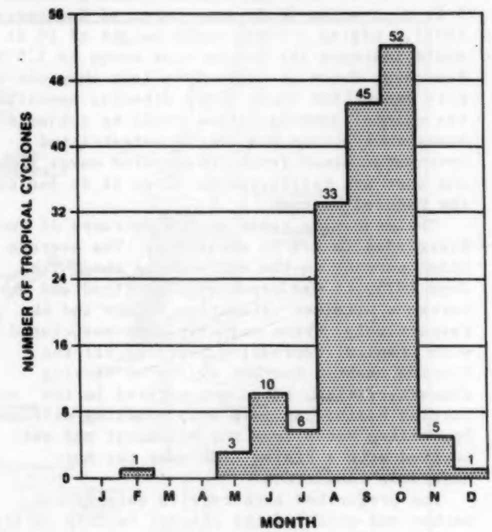


Figure 4.-- Monthly totals of tropical cyclones that passed within 180 mi of Port Everglades from 1871-1979.

threat is from the east, but also a high threat exists for all southern approaches (fig. 5).

For the 2.5° latitude-longitude box containing Port Everglades (Neumann and Dryslak, 1981), about 61 percent of the tropical storms

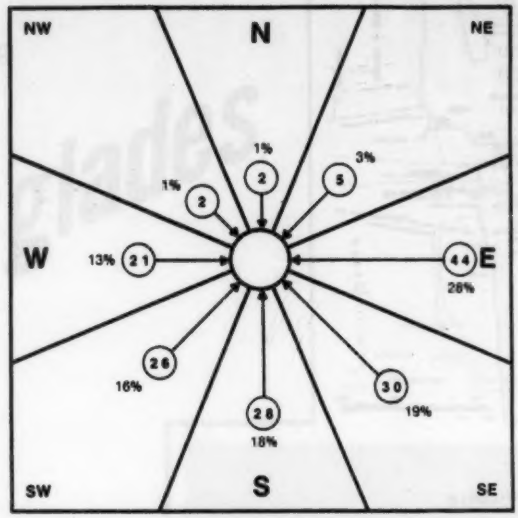


Figure 5.-- Directions of approach of tropical cyclones that passed within 180 mi of the port (1871-1979). Circled numerals show number of storms and percentages are percent of total from each octant.

and hurricanes passing through this area have hurricane force winds. This compares, for example, to 48 percent for Puerto Rico and 36 percent for both New Orleans and New York. Of the 103 tropical cyclone threats from 1899-1979, 52 had hurricane winds and of these, 40 occurred in September and October (Table 1).

Table 1.-- Classification of tropical cyclones that passed within 180 mi of Port Everglades during the period 1899-1979.

Maximum Intensity*	Nov May	June July	Aug	Sept	Oct	Totals
Hurricane (≥64kn)	2	4	6	19	21	52
Intense Tropical Storm(48-63kn)	1	4	5	3	5	18
Weak Tropical Storm(34-47kn)	1	2	5	5	5	18
Tropical Depression (<34kn)	-	3	5	5	2	15
TOTALS	4	13	21	32	33	103

*Intensity values reflect the maximum intensity while in the 180 mi critical radius of Port Everglades.

Statistical summaries of threat probability (1871-1979) are shown in figures 6-9. The thin lines are percent threat while the thick lines represent the approximate climatological approach time to Port Everglades. For example

in figure 7, a tropical cyclone located at 22°N, 67°W has about a 40 percent probability of passing within 180 mi of the port and should reach the harbor in 3 to 4 days.

Figure 6 shows the threat from November

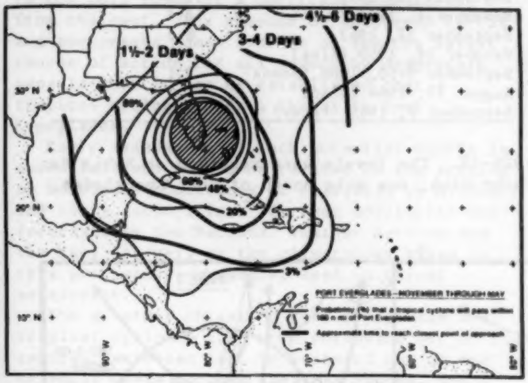


Figure 6.-- Tropical cyclone probability and approximate approach time during Nov.-May (data base from 1871-1979).

through May but is based upon only 10 tropical cyclones over the 109-yr period. The primary threat axis originates in the western Caribbean and extends northward across western Cuba to Port Everglades. This becomes a secondary axis during June and July (fig. 7). The main threat axis has shifted dramatically eastward to just north of Hispaniola and Puerto Rico. The track

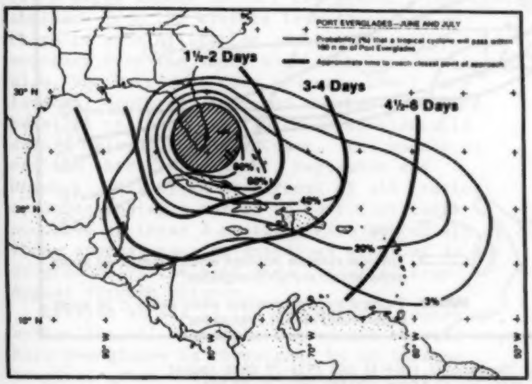


Figure 7.-- Tropical cyclone probability and approximate approach time during June and July (data base from 1871-1979).

passes north of the West Indies. During August and September (fig. 8) storm frequency has increased as the main threat axis has shifted. With many storms originating east of the Lesser Antilles the track extends through the northeastern Caribbean west-northwestward to Port Everglades. A secondary axis origniates in the central Caribbean and extends across Cuba to

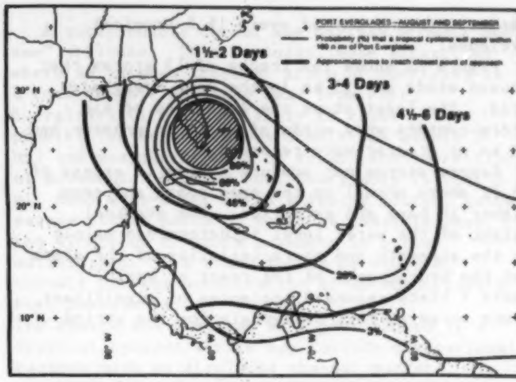


Figure 8.-- Tropical cyclone probability and approximate approach time during Aug. and Sept. (data base from 1871-1979).

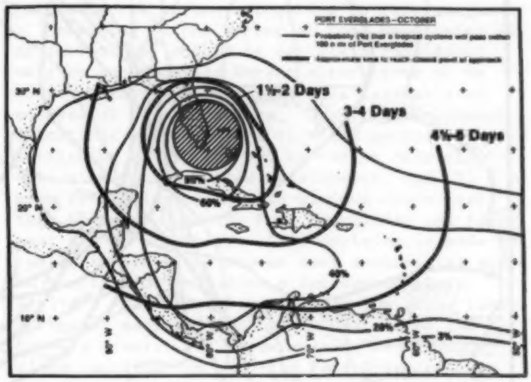


Figure 9.-- Tropical cyclone probability and approximate approach time during Oct. (data base from 1871-1979).

the port. By October (fig. 9) the main threat axis has shifted back to the western Caribbean, south of Cuba. A secondary extension has its origins east of the Lesser Antilles (south of 15°N). It passes through the Caribbean to join the major track south of Cuba.

During the 22-yr period for which wind data are available, 33 tropical cyclones threatened Port Everglades -- an average of 1.5 per year. (Wind records for this study were from Port Lauderdale-Hollywood International Airport, located about 2 mi southwest of the port.) Of these storms, there were 12 hurricanes, 8 tropical storms and 13 tropical depressions.

Six of the 33 cyclones caused sustained winds of 34 kn or greater in Port Everglades area. Two of the six generated hurricane force sustained winds and five caused gusts to hurricane force. Based solely on 1944-46 and 1959-79 wind data, gale-force winds can be expected from 1 out of every 5.5 tropical cyclones passing within 180 mi of Port Everglades, and hurricane force winds can be

expected from 1 out of every 16.5 tropical cyclones.

Figure 10 shows the tracks of 13 storms that caused winds of ≥23 kn in the Port Everglades area. The inset shows the locations of six storm centers when winds of 23 kn or greater and 34 kn or greater were recorded.

Severe storms may produce surges in excess of 25 ft above normal on the open coast and even higher in bays and estuaries. The eventual height of the water level is determined mainly by the strength and characteristics of the storm and the hydrography of the coast or basin. Table 2 lists recorded instances of significant storm surge at Fort Lauderdale for the period 1926-79. The levels were recorded at Bahia Mar Yacht Club, one mile north of Port Everglades.

Table 2.-- Hurricane water levels above National Geodetic Vertical Datum, 1926-1979. (National Hurricane Center).

Hurricane Date/Name	Water Level at Fort Lauderdale (ft)
September 18, 1926	12.6
November 4, 1936	8.8
September 17, 1947	6.5
October 18, 1950 (King)	6.0
September 9-10, 1960 (Donna)	3.1
August 27, 1964 (Clec)	5.0
September 8, 1965 (Betsy)	7.0

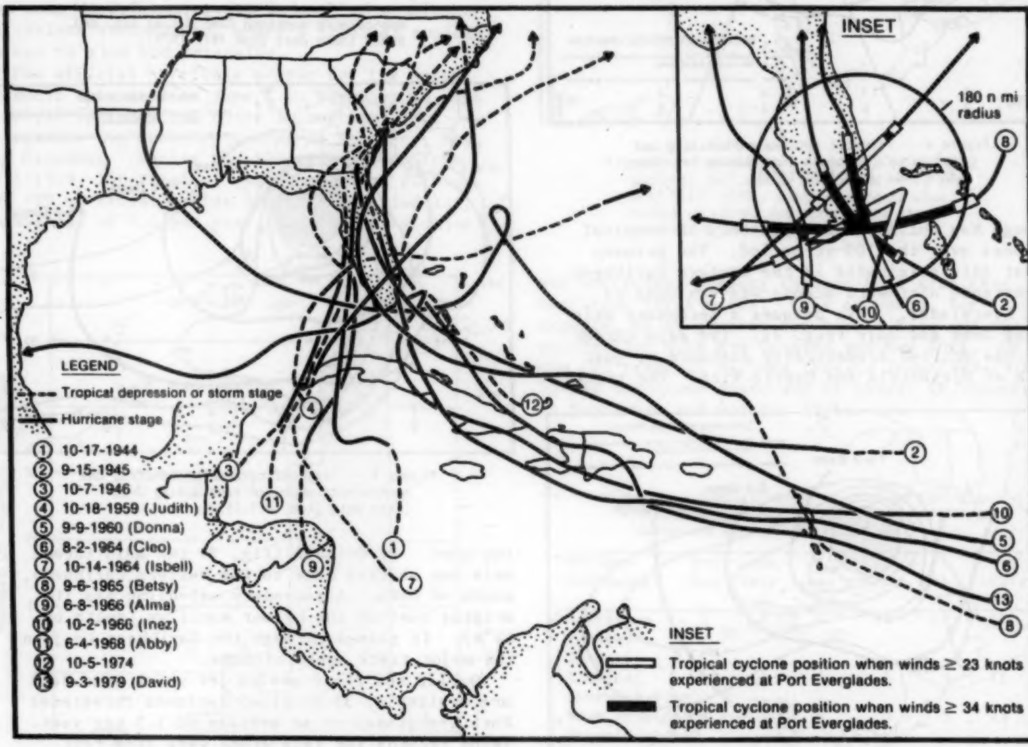


Figure 10.-- Tracks of 13 tropical cyclones during the periods 1944-46 and 1959-79 that caused winds of 23 kn or greater at Port Everglades. Locations of storm centers when winds were 23 kn and 34 kn or greater at Port Everglades are shown in the inset.

The Decision

Port Everglades is at considerable risk to damage from both tropical cyclone storm surge and high wind. The nearness of the harbor to the open ocean suggests that the port is subject to the full force of a hurricane approaching from the east. The absence of sheltered berths and anchorages makes evasion at sea the safest course of action for all seaworthy deep-draft vessels when it can be established that a tropical cyclone poses a threat to Port Everglades.

Early assessment of each potential threat is essential, and should be related to the setting of hurricane conditions of readiness by military and civil authorities. Current advisories and forecasts by the National Weather Service and the Navy, as well as the climatology given in this port study, should be used in threat assessment.

The greatest threat to Port Everglades are tropical cyclones that move northward out of the central Caribbean Sea, or westward out of the Atlantic Ocean through the West Indies, and approach Port Everglades from the east-through-south-to-west octants (figs. 4 through 9). A greater threat of storm surge occurs when a tropical cyclone approaches Port Everglades from the east quadrant and makes landfall within 50 mi south of the port. The port is susceptible to high winds from all quadrants -- particularly from the east.

As a general rule, if an intense tropical storm or hurricane approaches from the Atlantic, east of the port, the dangerous right front quadrant of the storm can cause severe wind and storm surge damage to Port Everglades. Overland approach from the west is less dangerous as there is some mitigation of wind intensity. An approach from the south should be less dangerous also, but hurricane Cleo (August, 1964) made landfall south of Miami and tracked northward, parallel to the coast, to cause considerable damage well up the East Coast. The months of maximum threat are August, September and October. Eighty-three percent of all tropical cyclones posing a threat to Port Everglades occurred in these 3 months. Five out of six of those storms, causing sustained winds of 34 kn or greater in the port area, occurred from August through October.

Evasion at sea is the recommended course of action for all seaworthy deep-draft vessels when Port Everglades is threatened by an intense tropical storm (>48 kn) or hurricane ($\geq$64kn). The decision to evade at sea must be timed to allow safe passage to open waters. The timing is affected by:

(1) Preparation time necessary to get underway.
(2) Forward speed of the tropical cyclone.
(3) Forecast radius of high winds that would hamper or prevent a vessel's capability to maneuver to open water.
(4) Direction of ship's track relative to storm.
(5) Number of hours of daylight.

A questionable threat may dictate a "wait and see" attitude. This includes those situations where an intense tropical storm or hurricane is a considerable distance away from Port Everglades (i.e., not likely to cause prohibitive departure sea conditions within 24 hr) and meandering with no established direction of movement. Because Port Everglades is just 2 mi. from deep-water ocean shipping routes, quick escape either north or south is possible once the direction of storm movement is better established. The storm should be watched closely for any acceleration of movement toward Port Everglades.

The damage and disarray at a port caused by a tropical cyclone strike may include navigational hazards such as displaced channel markers, wrecks in the channel, or channel depth that no longer meet project specifications. Harbor facilities may be so damaged as to preclude offering even minimal services. Check with the Port Director before attempting to return.

Remaining in the harbor at Port Everglades is an option that should be seriously considered only in questionable threat situtations or in those instances when a vessel is incapable of successful evasion at sea. Questionable threat situations include (1) a tropical cyclone developing within the 180 mi radius critical area with forecast slow development, and (2) a weak tropical cyclone with maximum winds less than 48 kn approaching Port Everglades and forecast not to intensify. If a decision is made to remain in port, the proper port authorities must be notified 36 hr before a forecasted storm arrival. For those vessels over 100 gross tons, a request must be made to the Captain of the Port in Miami. For those vessels remaining, close coordination with the Port Director is required to obtain the best berthing available. The northern and southern extensions of the turning basin may offer marginally better wind protection, but the entire port area is subject to high winds. It is recommended that vessels be ballasted down as much as possible, and secured to the dock with sufficient lines to withstand predicted wind forces, yet allow for water height fluctuations of the predicted amounts.

Remaining in port exposes a vessel to hazards beyond those of wind and storm surge. Vessels may break loose from their moorings and become floating hazards, or a damaged or sunken vessel could effectively block the ship channel to the ocean.

Thousands of shallow-draft boats are moored in the extensive canal system just north of Port Everglades. If feasible, they should be removed from the water and transported inland to higher elevations. The elevations in the immediate area offer little protection if there is a significant rise in the water level. Because of the many boats in the area it might not be possible to seek protection up a canal or river unless departure is quite early. Many bridges with low vertical clearance might further hinder such a plan. Boat owners in this area should

prepare an escape and implement it early to avoid the many people who may use the roads to leave the low lying coastal areas. If a boat must be moored in place, it should be ballasted to be low in the water to escape wind effects and be well secured with allowance for increased water heights.

Port Everglades' harbor area is advantageously situated only about 2 mi from the normal deep-water shipping routes, which significantly reduces transit time to the open ocean. Once in deep water the vessels' tactics will depend on the location of the threatening tropical cyclone, its speed of advance, and its direction of movement.

Hurricane Condition IV (equivalent to U.S. Navy Hurricane Condition III) is set by the U.S. Coast Guard when hurricane force winds are possible within 48 hr. The decision to prepare for evasion should be made soon after this condition is set. Although the storm center may be more than 500 mi distant the average tropical cyclone forecast error, for this area, over a 48-hr period is 200 mi. Departure coincident with the setting of this condition is considered to be the wisest and safest course of action. Later departures wager the accuracy of information on the storm's behavior against mounting risks of heavy weather damage. Once sea room is attained, up-to-date information can be used to make sound decisions. Storm location and intensity information is accurate and timely. Forecasts and warnings are issued at 6-hr intervals and updated as necessary to reflect important changes in position, intensity, and movement. Ship captains with access to these advisories and warnings are in the best possible position to modify evasion routes and tactics.

The cardinal rule of seamanship is to avoid the dangerous right-hand semicircle. The following guidelines are offered:

(1) Tropical Cyclones Approaching from the Northeast or East. After departure, steam south along the Florida coast and keep a close eye on the storm, whose normal tendency will be to move westerly or recurve to the north. If necessary, clear the storm to the southeast or southwest, north of Cuba. A tropical cyclone from the northeast is likely to be an early or late season (or off season) storm and may be more erratic in behavior due to unseasonal steering patterns.

(2) Tropical Cyclones Approaching from the Southwest or South. Steam to the northeast to clear Grand Bahama Island and then east to clear the tropical cyclone. The preferred storm track should be to the northwest or to the northeast on a recurvature path, either of which will be easy to clear.

(3) Tropical Cyclones Approaching from the Southwest or West. These storms will have crossed Florida, but should not be discounted as threats. Much of south Florida is composed of the Everglades which can still provide a source of heat energy and moisture to the storm. The flatness of the land mass also may not mitigate the wind intensity to any significant degree. For these tropical cyclones, proceed as in (2) above.

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Great Lakes Navigation Season, 1985

Elwyn E. Wilson
National Oceanographic Data Center
Washington, D.C.

The Seaway and Canals opened on schedule on April 1. The MENHIR was the first ship upbound on the St. Lawrence Seaway (fig. 11).

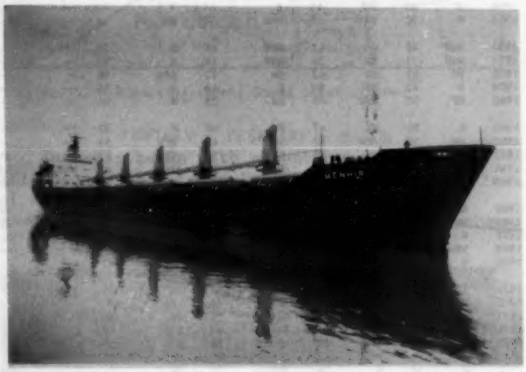


Figure 11.-- The years first upbound vessel.

The JEAN PARISIEN was the first vessel downbound on April 2. On the Welland Canal the ALGOWEST was the first vessel upbound. There was no indication of which vessel was first downbound but several lakers had wintered in the upper canal.

At the Soo the JOHN B. AIRD was the first upbound and the ALGOCEN the first downbound.

The Seaway again closed later than usual, partially to accomodate ships that were delayed by the closing of the Welland in October when a wall of Lock 7 collapsed. The CARTIERCLIFFE HALL was the last downbound on December 30 and the STEELCLIFFE HALL was last upbound on the 29th. The Welland offically closed December 30 but the last passages were on the 29th; the CANADIAN TRANSPORT downbound and the CHEMICAL TRANSPORT upbound. The icebreakers NEAH BAY and GRIFFON were the last upbound but it was on the 31st after the official closing. At the Soo the JOHN B. AIRD was the last downbound and the ALGOPORT the last upbound. As usual a few lakers operated all winter, many times requiring icebreaking assistance (fig. 12).

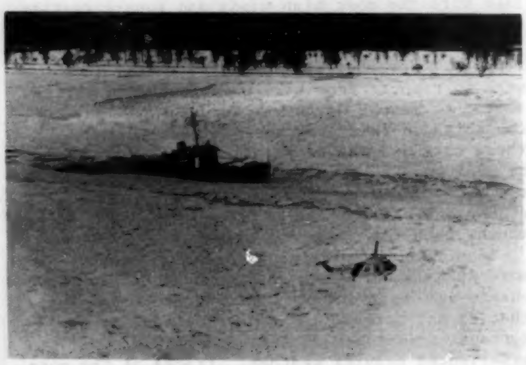


Figure 12.-- A welcome sight on the Lakes.

Official precipitation data was available only through September and at that time all Lakes were above normal for the nine months. The Basin as a whole was 18 percent above normal.

National Weather Service

The National Weather Service conducted their Marine Weather Program as usual. The products and services included weather warnings, forecasts, advisories and statements; ice forecasts and outlooks; low water statements, and lake shore warnings and statements. The total number of gale and storm warnings were 168, above last year but below most previous years (table 1). Only 14 storm warnings were issued. Lake Superior led the list of warnings.

Great Lakes Warnings - 1985

	Super.		Mich.		Huron		St. Clair		Erie		Ontario	
	G	S	G	S	G	S	G	S	G	S	G	S
Jan	6	1	6	0	4	0	0	0	5	0	1	0
Feb	4	0	5	0	1	0	0	0	1	0	0	0
Mar	6	1	6	0	5	1	6	1	2	1	0	0
April	4	1	3	0	3	0	2	0	1	0	0	0
May	0	0	3	0	0	0	0	0	1	0	2	0
June	4	0	2	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0
Aug	0	0	0	0	0	0	0	0	0	0	0	0
Sept	5	1	2	0	1	0	0	0	0	0	0	0
Oct	5	0	2	0	3	0	2	0	1	0	0	0
Nov	6	1	4	0	5	1	2	0	4	0	1	0
Dec	5	1	6	1	7	1	1	0	5	1	4	1
Totals	45	6	39	1	29	3	13	1	20	2	8	1

1985-168

Table 1.-- The number of gale (G) and storm (S) warnings for 1985.

Table 2 is incorrect for the number of observations submitted for the months of August and October. Therefore, the totals are incorrect. The port meteorological offices at Chicago and Cleveland indicated that 1,200 observations were submitted to them for August and 873 for October and forwarded to the National Climatic Data Center. This makes a

grand total of 9,233. It has not been determined as yet why they were not all counted by the computer. The PMO's had no records of which Lakes the observations were taken on, only the totals.

TOTAL COUNT OF SHIP OBSERVATIONS FOR 1985

LAKE	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTALS
ONTARIO													
ERIE			1	37	44	56	34	12	49		36	34	303
HURON			3	176	299	313	243	18	280	19	207	155	1723
MICHIGAN	40	40	52	187	365	360	452	18	386	18	252	186	2354
SUPERIOR				276	544	461	433	30	481	14	399	142	2780
TOTALS	40	40	56	676	1252	1200	1162	78	1196	51	894	515	7160

TOTAL NUMBER OF SHIPS REPORTING 47

Table 2.-- Total count of ship observations.

Observation Program

The National Climatic Data Center received only 7,160 observations from the 47 ships that participated in the program during 1985. This was down considerably from 1984. Only synoptic observations submitted on the Great Lakes Ships' Weather Observations, NOAA form 72 - 1A (GL) were included in the total (table 2). There were more observations from Lake Superior, as usual. The highest monthly total was during May.

Table 3 shows a breakdown of the observations for selected severe weather types. Low visibility lead the bad weather reports with winds greater than 30 kn a second. May had the highest number of low visibility reports -- 125. December had the highest percent of low visibility observations at 15 percent and April had 13 percent.

	WINDS	VISIBILITY	SEVERE WX	SEA HEIGHTS	
SELECTION CRITERIA	>30KN	CODE< 96	CODE=13,17-19,24, 27,29,57, OR > 86	CODE=8-12 (12 TO 20 FT)	CODE >12 (>20 FT)
TOTAL # OF OBS	262	601	153	17	3

Table 3.-- Summary of selected severe weather data.

Tables 4 and 5 shows the data for high winds. The highest waves were 18 ft. on Lakes Michigan and Superior. The highest wind was 55 kn on Lake Michigan during November. Lake Superior had the most high wind observations (over 33 kn) at 77. Lakes Erie, Huron, and Michigan totaled 85.

LAKE	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTALS
ONTARIO													
34-40													
41-47													
48-55													
56-63													
ERIE													
34-40				1	1						3	5	10
41-47												1	1
48-55													
56-63													
HURON													
34-40				1	1	2	1		1	1	10	7	24
41-47				1		1			1	1	1		5
48-55													
56-63													
MICHIGAN													
34-40	1	4	1	4	1	2	2		9	1	8	5	30
41-47				1					1		2	1	5
48-55											1	1	2
56-63													
SUPERIOR													
34-40				5	5	4			8		26	13	59
41-47				2	1				6	1	4	1	15
48-55				1					1		1		3
56-63													
TOTALS													
34-40	1	4	1	11	8	8	3		18	2	45	30	131
41-47				4	1	1			8	2	7	3	26
48-55				1					1		2	1	5
35-63													

Table 4.-- High wind speed distribution (kn).

This article and the tables are based only on those observation logged on NOAA form 72-1A (GL) and forwarded to the National Climatic Data Center, Asheville, NC.

YEAR	LAKE ERIE		LAKE HURON		LAKE MICHIGAN		LAKE SUPERIOR		LAKE ONTARIO	
1941	W	42	WSW	50	NW	43	NNW	54	—	—
1942	WSW	52	WSW	56	WNW	48	S	62	—	—
1943	WSW	57	WNW	43	SSW	50	WSW	52	—	—
1944	NE	38	NW	37	WSW	48	NNE	42	—	—
1945	WNW	52	SSW	54	WNW	49	NW	52	—	—
1946	SW	50	W	46	S	44	NW	47	—	—
1947	NW	51	SSE	43	ENE	39	WSW	43	—	—
1948	WSW	40	NNW	51	NW	45	WSW	48	—	—
1949	W	52	NNE	50	WNW	43	N	52	—	—
1950	SW	70	NW	48	NW	49	NW	81[1]	—	—
1951	WSW	37	WSW	50	SW	49	WSW	54	—	—
1952	SW	46	SW	57	SSW	44	WSW	45	—	—
1953	WSW	49	NW	45	NNW	46	ENE	50	—	—
1954	W	45	NW	45	E	48	N	43	—	—
1955	W	52	SW	57	WSW	58[1]	NW	48	—	—
1956	WSW	46	W	43	SSW	46	N	50	—	—
1957	WSW	72	SW	54	WSW	49	W	47	—	—
1958	SW	61	SW	43	SW	52	SSW	54	—	—
1959	W	42	NE	50	E	48	W	54	—	—
1960	NE	55	WSW	49	NW	55	N	54	—	—
1961	W	50	NW	47	NW	48	N	57	—	—
1962	NW	52	WNW	63	NW	48	NNW	60	—	—
1963	NNW	74	NW	60	N	52	NNW	52	E	35
1964	WSW	68	W	72	NW	54	WSW	62	WNW	50[1]
1965	WSW	60	WNW	95[1]	ESE	52	SW	70	W	40
1966	ENE	49	NE	60	NW	57	NNE	61	W	39
1967	WSW	43	W	58	ENE	55	NE	53	W	32
1968	W	63	NNW	44	WNW	46	NNE	55	SW	31
1969	WSW	44	NNW	46	NW	50	SSW	50	—	—
1970	W	52	W	62	NW	52	W	63	—	—
1971	SW	50	N	53	N	50	SW	56	—	—
1972	W	45	NW	56	N	54	NNE	60	—	—
1973	SW	45	ENE	44	NE	56	NE	50	—	—
1974	ENE	48	SW	47	SW	42	ESE	46	W	38
1975	NE	40	WSW	60	SW	54	W	50	NW	32
1976	W	48	S	56	NNW	55	NE	54	W	34
1977	WSW	44	SE	48	ESE	44	SW	56	NW	26
1978	SSW	80[1]	ENE	50	E	55	S	56	WNW	33
1979	W	42	W	44	WNW	55	NNE	52	W	26
1980	NNE	44	N	50	NNE	52	S	56	—	—
1981	W	55	NW	50	NW	50	ENE	56	SSE	37
1982	W	43	W	53	SW	42	N	60	—	—
1983	SW	45	NE	49	W	56	NW	48	—	—
1984	S	40	WSW	56	W	50	N	56	—	—
1985	WSW	44	WSW	45	SSW	55	W	48	—	—

[1]Highest for each lake

Table 5.-- Highest 1-min. wind (kn) reported on the Great Lakes by U.S. Anemometer equipped vessels.

Notable Weather Happenings

Lake Superior was apparently the stormiest lake with the most high winds and severe weather observations. Lake Michigan had the highest single wind and two of the three 18-ft wave reports. November was the worst month. There were no reports from Lake Ontario that qualified as bad or severe weather. Very few, if any, of the ships in this program enter Lake Ontario. These data and the number of observations must be evaluated in terms of the season and the number of boats operating. The most severe storms generally occur in the fall and winter months when few boats are operating.

The following paragraphs describe some of the more significant weather as indicated by weather charts and observations. Canadian ships and ships that do not forward their observations to the National Climatic Data Center may have experienced heavier weather. Tracks of the more severe storms are shown in figure 13.

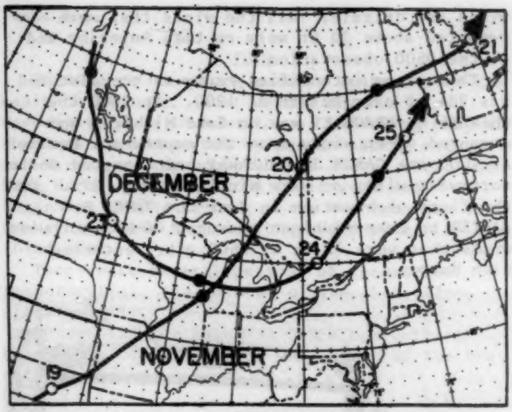


Figure 13.-- A pair of severe Great Lakes storms.

JANUARY - FEBRUARY - MARCH

The year began with a bang over the Lakes (fig.14). On New Years Day there was up to 10 in of snow over portions of Michigan and winds gusted to 71 mph at Buffalo. A few boats on the

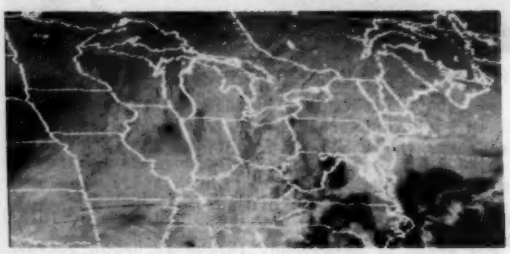


Figure 14.-- Happy New Year to Buffalo.

Lakes continued to operate (fig. 15) during the winter months. Forty observaitons were received at the National Climatic Data Center during both January and February and 56 during March. The CITY OF MIDLAND, S.T. CRAPO, JAMES A. HANNAH, AMOCO MICHIGAN, AMOCO GREAT LAKES, BARBARA

Figure 15.-- Finnish tanker KIISLA was a winter carrier.

ANDRIE, and JUPITER were reported to be running; the CITY OF MIDLAND and S.T. CRAPO sent observations. The Coast Guard ships also operated.

On January 13 a 990 mb storm tracked across the northern edge of the Lakes. A storm warning was issued for Lake Superior and gale warnings for Michigan and Huron. At 2300 on the 12th the CITY OF MIDLAND measured 36-kn west winds at 3°C on Lake Michigan. Cold northerly winds blew over the lakes from the 19th to the 23d. On the 25th there was snow and gale warnings for Lakes Superior, Michigan and Erie. It was a snowy month for Erie, PA. They only had 3 days without snow during the month and snow was reported for 20 consecutive days. More then 55 in fell.

The first week of February the Lakes were generally under high pressure. The second week a large LOW over the Labrador Sea extended its cyclonic circulation over the eastern Lakes. A narrow ridge of high pressure stretched over Lakes Superior and Michigan. On the 13th a LOW was centered north of Erie and the CITY OF MIDLAND had 34-kn north winds and 12-ft waves on Michigan. Heavy snow for several days caused the roof of a warehouse to collapse on the 14th. Alpena MI had 33 in, Sault Ste. Marie had 23 in and Grand Rapids 21. Buffalo had winds of 37 mph with gusts to 51. Weak pressure systems moved over the area for the next 10 days with above freezing temperatures and rain on the 22d. On the 28th a storm was moving across Hudson Bay and the CITY OF MIDLAND found southwest winds as high as 38 kn.

During the month tugs had to help ships caught in ice, including the BARBARA ANDRIE, CANONIE 40, S.T. CRAPO, and CITY OF MIDLAND. At the end of February Lake St. Clair hit a new high water level.

March was a windy month for part of the lakes. On the 4th a cyclone was centered near Omaha, NB and a HIGH at the tip of James Bay. Snow turned to rain over the western lakes and Duluth measured 47 mph east winds on the 3d and 57 mph on the 4th. On the 5th Buffalo had 55 mph at the airport as the storm passed over the center of the lakes.

Fairly normal weather continued until the 12th when a LOW moved over the area. Winds of 59 mph were observed at Buffalo Airport and 66 mph downtown. Damage was caused across the south shore of the Lake. The S.T. CRAPO had 31-kn winds on Lake Michigan.

The last half of the month the Lakes were generally under high pressure with occasional weak LOWs. On the 27th a significant storm moved over the area. Winds gusted to 50 mph at Buffalo. The CITY OF MIDLAND had 36-kn south winds. During mid-March the tugs BARBARA ANDRIE, KAREN ANDRIE, MARY E. HANNAH and JAMES A. HANNAH had tough going in the Straits in ice. A few boats started moving early; the HENRY FORD II was in Toledo on the 18th.

On the last day of the month a storm was centered southwest of Chicago. Sault Ste. Marie had gusts to 53 mph.

APRIL

The Great Lakes were in a col area on the average as far as pressure was concerned this month. There was high pressure to the north and south and low pressure to the east and west. There was a minus 3 mb departure from normal centered over Lake Superior.

Lakes Michigan, Huron, St. Clair and Erie were at record levels.

The major storm of the month came out of the Great Plains as two frontal waves on the 4th and 5th. By the 6th they had combined into one 985 mb LOW near South Bend, IN. Early on the 5th there were a few near gales, but by 1800 the EDGAR B. SPEER off Ludington, on Lake Michigan, measured 43-kn northeast winds. At 1200 on the 6th the storm was 973 mb over the North Channel. The WILLIAM J. DELANCEY, on eastern Lake Superior, measured 48-kn winds from 030° (fig. 16). The EDWIN H. GOTT on Lake Huron found 45-kn southwest winds. The WILLIAM A. ROECH on western Lake Superior measured 42-kn northeast winds. By the 7th the storm center was over Quebec Province.

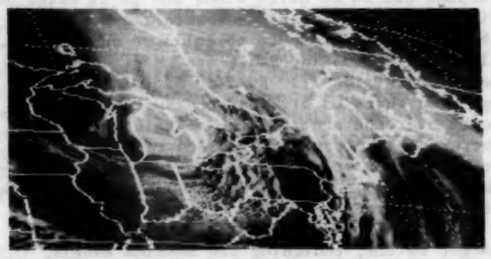


Figure 16.-- Great Lakes storm at 1700 on April 16.

On the 16th a front moved southeastward across the basin. The PRESQUE ISLE on Whitefish Bay had 45-kn winds with 16-ft waves after frontal passage. The J.A.W. IGLEHART, on Lake Huron, had 40-kn north winds.

Several ships had problems in ice. The JAMES A. HANNAH overran her barge and ripped an 18-ft gash in her hull. The SAM LUND got stuck at Buffalo. Both United States and Canadian ice breakers were needed, particularly early in the month, but nothing like late April 1984. The MENHIR almost ran aground in high winds entering Eisenhower Lock. A mud shoal formed in Duluth Harbor over the winter and the BELLE RIVER, BLUE PINE, INDIANA HARBOR, and WILLIAM J. DELANCEY rubbed bottom.

MAY

Lakes Michigan, Huron, St. Clair, and Erie, were still near record levels. The monthly mean sea-level pressure was near 1012 mb about 2 to 4 mb below normal. With the lake water still cold warm air fog was prevalent.

The strongest wind for the month was 42 kn with a storm that tracked eastward slightly north of the Lakes on the 13th.

The EDGAR B. SPEER on the 3d was on Lake Superior at 0600 with 42-kn winds from 250°. The WILLIAM J. DELANCEY was nearby with 40-kn winds and drizzle. All the winds that were reported above 30 kn were on Lake Superior and at the 0600 observation.

This storm intensified early on the 31st and was 984 mb over Duluth at 1200. At 1800 the CHARLES M. BEEGHLEY was on Lake Michigan and measured 40-kn winds from the southwest. Earlier at 1000 the CASON J. CALLAWAY had reported 36-kn northwest winds on Lake Michigan (fig. 17). On the first observation in June the JAMES R. BARKER on Lake Michigan measured 40-kn southwest winds that were 42 kn at 0600 after entering Lake Huron.

Figure 17.-- One of the more dependable weather observers.

On the 31st Buffalo measured a wind gust at 43 kn with thunderstorms in the area. Milwaukee had gusts to 54 kn and Detroit 48 kn.

JUNE

In the mean the Great Lakes were under a southwest flow with a sea-level pressure of 1012 mb. This was about 2 mb lower than the 30-yr normal. The strongest wind by participating ships was 42 kn on the 1st from a storm that originated in May. There were two reports of 18-ft waves this month, the highest for the year. One was on the 6th on Lake Michigan by the EDGAR B. SPEER and the other on the 22d on the Lake Superior by the PRESQUE ISLE.

On the 9th a frontal system moved across the basin. Ships only reported minimal gales. The PRESQUE ISLE on Lake Michigan had 33 kn in a thunderstorm. Buffalo measured 47 mph. Sault Ste. Marie measured 48-mph gusts. The WILLIAM CLAY FORD had 35-kn winds on Lake Superior.

A storm approached the Lakes on the 21st. It consisted of a cold front from the north and a LOW from the southwest that combined on the 22d. The first 35-kn winds were reported at 0600 on Lake Michigan by the MYRON C. TAYLOR. Winds of 31 and 32 kn were reported on Lakes Huron and Superior by the JAMES R. BARKER and J.A.W. IGLEHART. At 1000 the CITY OF MIDLAND sent a special observation of 32 kn from Lake Michigan. The ST. CLAIR was on western Superior at 1800 with winds of 32 kn and 10-ft waves.

On the 23d the higher winds were 33 to 35 kn and all on Lake Superior. They were reported by the GEORGE A. STINSON, WILLIAM J. DELANCEY, and COLUMBIA STAR. The storm was 985 mb west of

James Bay.

JULY

There were no strong weather systems over the basin this month. Most severe weather was associated with thunderstorms. Speaking only of thunderstorms reported by participating ships; on Lake Erie they occurred the second week; on Lake Huron the end of the first week and beginning of the second; Lake Michigan the last week; and Lake Superior they were primarily the third week.

There were several periods of record low temperatures; the morning of the 11th, 12th, 17th, and 23d.

On the 23d the ARAWANNA QUEEN encountered high waves off Vermilion, OH and one of the bow picture windows popped out.

AUGUST

For some reason, that can not be determined, the number of ship observations from the Great Lakes on record at the National Climatic Data Center dropped drastically this month to only 78. Contacts with the PMO's Cleveland and Chicago determined that 1200 were mailed to Asheville.

The Great Lakes basin was under the influence of the Bermuda High according to the monthly mean sea-level pressure at about 1017 mb. This was about 1 mb above normal. The highest wind was 32 kn on Lake Michigan by the J.L. MAUTHE on the 13th. The past weather indicated a thunderstorm . There were no severe weather reports from Lake Erie and Superior but the weather charts indicated it occurred. The Lake levels remained high. On August 2 Chicago set a new record low temperature of 50°F.

On August 18th CHI-CHEEMAUN grounded in fog leaving South Baymouth. According to Lakes Log Chips the CITY OF MIDLAND ran into a storm with wind gusts up to 90 kn leaving Kewaunee on the 5th. The crew saw it coming and got the passengers off the decks and headed into it. There was no damage except for the loss of deck chairs and trash containers.

SEPTEMBER

The number of observations rose back to normal this month. This basin was again under high pressure, 1016 to 1020 mb. A 1021-mb HIGH was west of Washington, DC. The average wind flow was from the southwest.

The weather was quiet for about the first 20 days except for weak frontal passages and a few thunderstorms. The first significant storm formed over the southern plains on the 22d and tracked northeastward. Late on the 23d it started affecting the Lake region. The MYRON C. TAYLOR, on upper Lake Michigan, had 38-kn southerly winds. The PHILIP R. CLARKE, nearby, reported 34 kn. At 0000 on the 24th the storm was 988 mb over Lake Superior. Several ships had winds over 40 kn. The JOSEPH L. BLOCK on mid Lake Superior measured the highest wind of the month with 48 kn from the west (fig. 18). The LEWIS WILSON FOY to the east had 45 kn as did the JAMES R. BARKER. The ERNEST R. BREECH on Lake Huron found only 31 kn from the south; no winds above 30 kn were reported on Lake Erie. The storm was 970 mb west of James Bay at 1200 on the 24th. The BURNS HARBOR still found 34-kn winds on Lake Michigan early on the 25th.

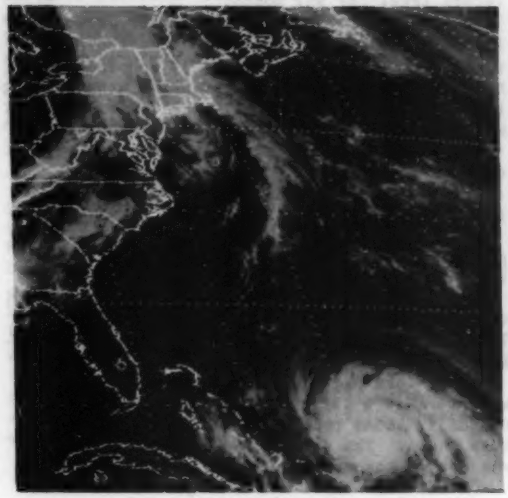


Figure 18.-- Lake storm with hurricane Gloria to the south on the 24th.

On the 28th and 29th a front was stationary across the Lakes. Analyses on the 29th and 30th showed weak stable waves on the front. A HIGH over eastern Pennsylvania was pumping moist air northward. An unstable wave formed over Oklahoma on the 29th and at 1200 on the 30th was near Milwaukee. All the winds over 30 kn were on Lake Superior. The strongest was 46 kn with 15-ft seas at 1800 on the 30th by the WILLIAM CLAY FORD. The EDWIN H. GOTT had 43 kn from the northeast. On October 1 the GEORGE A. STINSON measured 44-kn winds and 13-ft seas. The storm moved northward out of the area.

On the evening of September 2 the ST. CLAIR was outbound at Duluth and about to pass under the Aerial Bridge when the main engine shut down. The Captain used his bow and stern thrusters to prevent crashing into the bridge piers. Momentum carried the ship through the bridge where she struck the side of the channel. The wind was blowing hard and started the ship moving back through the bridge which had to be raised again. She came to rest in shallow water.

OCTOBER

There was a parade of HIGHs and LOWs across the Great Lakes basin this month. Most of the LOWs tracked north of the basin while the HIGHs tracked southeastward across the area. The average sea-level pressure was about 1018 mb which is about 1 mb above normal. Lakes Superior, Michigan, Huron, and St. Clair set

new record high levels. Lake Superior set a new record level for any month.

A 150-ft section of the lock wall of Lock 7 in the Welland Canal collapsed into the lock on the 14th, closing the canal. It reopened on November 7 when more than 140 ships were waiting to transit the 26-mi canal. The downbound FURIA was wedged in the lock but later floated free.

The National Climatic Data Center had only 51 observations in their computer system for October. PMO records indicate that 873 were sent.

On the 5th an Ontario man became the 7th person to survive going over Niagara Falls in a barrel.

The highest wind reported by a ship was 44 kn on the 1st from a storm that began in September. The GEORGE A. STINSON reported the high wind on Lake Superior with 13-ft waves.

A LOW formed over the midwest on the 4th and was near Green Bay at 992 mb on the 5th. The GEORGE A. SLOAN reported 40-kn south winds on Lake Huron. The storm moved northeastward and was out of the area on the 6th.

On the 12th there was a large LOW northwest of Lake Superior and a small LOW west of Duluth. At 1800 the small LOW was near Duluth. The GEORGE A STINSON, on Lake Huron measured 41-kn southeast winds in moderate rain. The small LOW was absorbed by the front out of the large northern LOW on the 13th.

On the 18th a frontal system was moving across the Lakes. At 0000 the GEORGE A. SLOAN was on Lake Michigan with 34-kn south winds.

A frontal system was moving across the Lakes on the 24th. Sault Ste. Marie reported 42 mph northwest winds with gusts to 51 mph.

NOVEMBER

This month is known for severe storms. The cyclones are more numerous, stronger and their tracks have moved south. All the Lakes set new record levels except Ontario. The mean sea-level pressure averaged about 1019 mb and ranged from normal at Chicago to over 4 mb above normal on Lake Superior.

The first severe storm of the month was a Lake Superior storm where all the winds over 30 kn were reported on the 8th. The 0000 analysis showed two small LOWs in the area. One north of Thunder Bay and the other north of Lake Ontario. The second highest wind of the month -- 48 kn -- was reported at 1800 by the AMERICAN MARINER. The COLUMBIA STAR found 40-kn winds. Several other ships had winds in the 30-kn range. They were the PRESQUE ISLE, JOSEPH L. BLOCK, and LEWIS WILSON FOX.

On the 10th there was a front with waves laying southwest to northeast over Lake Erie. A 1042-mb HIGH was west of Lake Winnipeg. There were gale-force winds north of the front on Lakes Huron and Michigan.

This was a case of a weak LOW but strong HIGH with a tight gradient. The center of a strong HIGH moved eastward slightly north of the Lakes on the 15th and 16th. A weak LOW moved northward to western Superior on the 16th. Most of the strong winds were gales but the GEORGE A. STINSON found 40-kn southeast winds on Lake Superior.

One LOW of this storm formed over the Great Plains on the 18th and moved northward to near Duluth on the 19th. The WILLIAM J. DELANCEY had 46-kn winds on Lake Superior with 13-ft seas. On the 0000 analysis, on the 20th, another LOW was found near Chicago. By 1200 this was the primary storm at 980 mb at 50°N, 80°W. At 0600 the JAMES R. BARKER on Lake Michigan measured 55-kn winds. These were the highest winds measured this year. The EDWIN H. GOTT had 35-kn winds with squalls on Lake Erie. The BUFFALO on Lake Michigan measured 45-kn west winds. On the 21st the storm was entering the Labrador Sea and high pressure was moving into the basin. There were still reports of winds over 30 kn.

The FURIA was the first ship to pass through the Welland Canal, on the 8th, after a back wall collapsed on October 13. On the 4th, 5th, and 6th Buffalo set new daily rainfall records. A new record of 9.75 in was set for the month. The previous record was 6.71 in in 1927. They also recorded 46-mph winds with gusts to 61 on the 20th. On the 8th and 16th the gusts were 51 mph. On the 10th and 11th there were high winds with gusts to near 50 mph with 5-to 10-ft waves on the Wisconsin shore of Lake Michigan. On the 18th the SOCRATES was anchored off Duluth when 45-mph northeast winds caused her to drag anchors and run aground. The CAPE MONTEREY was blown into a pier at the Soo Locks on the 21st.

DECEMBER

The strongest storms occurred the first of the month and the last week. In between those two periods weak LOWs, fronts, and HIGHs were the weather producers. Chicago had its second coldest average temperature of 16°F compared to a normal of 27.7°F. Buffalo, NY, Erie PA, and Watertown NY set new snowfall records of 69.4, 59.9 and 108.1 in respectively. For Buffalo and Watertown this was the most in any month. The avearge sea-level pressure was about 1016 mb which was about 2 mb below normal.

The first storm was analyzed over Texas on the 0000 chart of the 1st. By 0000 on the 2d it had raced to central Lake Michigan at 988 mb. At 1800 on the 1st the PHILIP R. CLARKE had 43-kn northeast winds on Lake Superior. The temperature was -12°C. The ARTHUR M. ANDERSON had 2 cm of ice. On the 2d the GEORGE A. SLOAN on Lake Michigan had 40-kn southwest winds. The BUFFALO on Lake Huron also had 40 kn. On the 3d the storm was over Labrador.

Winds, over 60 mph with heavy snow hit the Great Lakes area (fig. 19) Waves of 12ft on Lake Erie caused flooding. A 15-ft wave on Lake Ontario washed a person off a breakwall at Oswego, NY. The winds gusted to 58 mph at Detroit and 66 mph at Buffalo. The St. Lawrence Seaway and St Marys River were closed to traffic. The high winds caused Lake Erie water level to drop 4 ft at the western end and pile up at the eastern end.

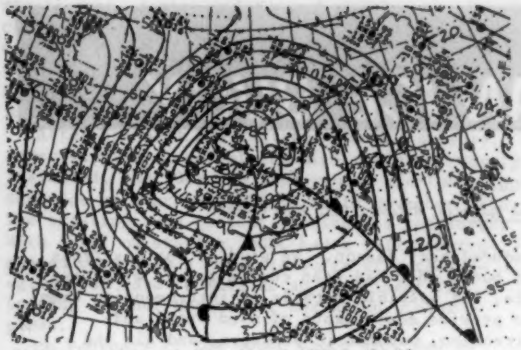


Figure 19.-- Storm on the Lakes at 1200 on the 2d.

The STEWART J. CORT and EDGAR B. SPEER broke their lines at Sturgeon Bay. The period from the 14th to 17th produced a series of weak LOWs and fronts. The PHILIP R. CLARKE had 44-kn winds with 12-ft waves on Lake Erie. On the 16th CHARLES M BEEGHLEY measured 36 kn on Lake Huron and was on Lake Superior on the 17th with 40-kn west winds and 8 cm of ice.

A frontal wave swooped southeastward out of Canada on the 23d than eastward across the Lakes. On the 24th it was north of Buffalo. The AMERICAN MARINER was off Milwaukee with 52-kn north winds and 12-ft waves. This was the highest wind for the month. The PAUL THAYER was farther north on Lake Michigan with 37-kn winds. By this time there were few ships operating. There were heavy snow warnings for the area with near blizzard conditions. Wind chill temperatures were as low as -50°F. There were lakeshore warnings for Indiana and southwest Michigan.

On the 27th there was a deep 954-mb LOW over northern Hudson Bay with another LOW over Thunder Bay. Only the CITY OF MIDLAND was reporting high winds of 32 kn on Lake Michigan. The northern LOW moved southward as the one near the Lakes raced northeastward. Gale warnings were up for the Lakes(fig. 20).

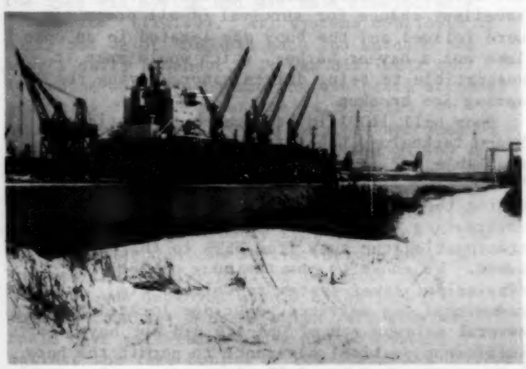


Figure 20.-- The FEDERAL SAGUENAY was the last vessel out of the seaway, clearing the St. Lawrence Lock at Montreal on Christmas night.

Ice was bad late in December. The J.W. WESTCOTT mailboat closed on the 17th, one day early. Ice punched holes in the bow of the PAUL THAYER on western Lake Erie. The GEORGE A. STINSON was stuck off Pelee. The ISLAND TRANSPORT, ONTADOC, MANTADOC, J. BURTON AYERS, and ROGER M. KEYES were stuck off Toledo. The ALGORAIL was stuck off Holland.

ACKNOWLEDGEMENTS

Appreciation is extended to the masters and mates aboard the cooperating vessels for their valuable observations and contributions to the National Weather Service observing program. Useful information and photographs were contributed by Albert G. Ballert of the Great Lakes Commission and gleaned from the Great Lakes News Letter and Lake Log Chips. Of primary importance were the wind, wave visibility, and severe weather observations preprared by the National Climatic Data Center, Asheville, NC, upon which much of the specific weather information is based.

SEARCH FOR AN ICE BUOY

Capt P.J. Kies
U.S. Coast Guard

(This article was excerpted from the Technical Bulletin, National Data Buoy Center)

Since 1979, the National Data Buoy Center (NDBC), under the auspices of the National Weather Service, has maintained a network of eight environmental data collection buoys on the Great Lakes (fig.21). The system employs three buoys on Lake Superior, two buoys on Lake Huron, two buoys on Lake Michigan, and one buoy on Lake Erie.

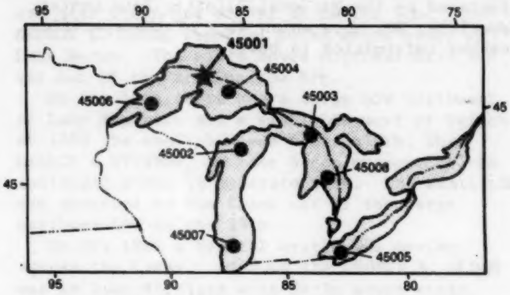


Figure 21.-- Buoy locations on the Great Lakes.

A major opertional consideration of this system is the severe winter weather, requiring retrieval of the buoys every autumn prior to the onset of lake iceover. Each spring the buoy must be redeployed using the Coast Guard buoy tenders and icebreakers after their normal duties of restoring aid-to-navigation (ATON) buoys and daymarks. This development and retrieval requires a major operational and logistical effort on the part of NDBC and the Coast Guard. Sometimes, the buoys are not actually deployed until early summer, well after the start of the shipping season, because of limited resources (buoy tender). Again, due to limited Coast Guard support and to preclude working under unsafe conditions (i.e., on ice-covered buoys), the buoys are normally retrieved prior to the end of the shipping season. Thus the beginning and ending of a shipping season is usually without the benefit of reports from these weather buoys.

Nearly every year, the Lake Carriers' Association and many NWS forecast offices in the Great Lakes Region request NDBC to accelerate deployment and retard retrieval of these buoys to provide weather data coverage on the Lakes through the entire shipping season.

Faced with limited Coast Guard resources to carry out our mission and the fact that "Mother Nature" takes over during the winter months, NDBC began searching for a solution to the reduced buoy season. We studied various types of buoys that had been customized to withstand ice, and possible methods of instrumenting them to provide measurments of wind speed and direction, barometric pressure, and air and water temperatures.

The Coast Guard has developed a new type of ice buoy that is 2.2 m (7 ft) in diameter and 6.1 m (20 ft) in length. This buoy is designed to "ride up" on light ice and to submerge under the ice during a "freeze-over." We took a serious look at "throw-away" sensors to instrument this type of buoy. An additional consideration was the loss of data collection in the spring after the buoy reappeared but prior to a service visit.

Another candidate for possible use as an ice Buoy was a 12-m, 90,720-kg (100 ton) discus buoy; a venerable hull that has survived many years in the North Atlantic and North Pacific Oceans. NDBC engineers ran several computer simulations of "worst case conditions," which indicated the buoy should survive the harsh Great Lakes, winter under all except extended, severe arctic-type conditions. Icing, ice floes, fast ice, buoyancy, ballasting techniques and freezing precipitation, were considered in selecion of the 12-m hull as a test platform. Also this class of buoy is scheduled for removal from the "fleet" and faces a trip to the scrapyard due to high annual maintenance costs when used in a saltwater environment.

Next, NDBC personnel conducted interviews with several Great Lakes ice " experts". They all agreed the buoy should have a good to excellent chance for survival if all precautions were follwed and the buoy was located in an open lake not a bay or harbor, which would make it susceptible to being driven ashore during the spring ice breakup.

Buoy hull 12D07 in storage at the National Space Technology Laboratories (NSTL), was available for immediate use as an experimental "ice buoy." It was readied for deployment during the summer months of 1985. An interesting logistics problem arose in transporting the buoy from NSTL to the Great Lakes. We chose to tow the buoy up the Mississippi River system to Chicago via commercial tug service. A bridge located several miles south of Chicago did not have sufficient vertical clearance to permit the buoy (with a mast height of 10 m) passage. A decision was made to cut the mast off the buoy at a level that would provide adequate clearance under the low bridge. Buoy 12D07 departed NSTL,

Mississippi, during mid-September and arrived in Chicago in early October. The Coast Guard Cutters KATMIA BAY and MOBILE BAY, 43-meter icebreaking tugs, shared in towing the buoy to Sault Ste. Marie, where it was reunited with its mast during the latter part of October.

After the mast was refitted and all sensors, power suppliers, and electronics equipment were installed, the buoy was deployed in mid-Lake Superior at station 45001 in early November 1985. The existing buoy on that station was retrieved. With 12D07 on station, NDBC had a fully instrumented buoy with a complete suite of meteorological and wave sensors as an experiment in beating "Mother Nature" at her harsh winter games.

On February 7, the Coast Guard provided an overflight of the buoy and took pictures of its condition (fig.22). The buoy had considerable ice accumulation but there was no lake ice in

Figure 22.-- First signs of ice were on Feb. 7th. USCG PHOTO.

the immediate area. On February 12, position data received from the buoy indicated it was moving slowly off station. An overflight conducted by Coast Guard on the 15th confirmed the buoy was moving and was amid considerable "brash ice" (fig.23). All systems continued to work, and we at NDBC sat back and watched the buoy's daily movement. It was difficult to determine whether the mooring was still attached and being dragged about the lake bottom, or if it had been severed. Figure 24 gives and idea of the considerable movement -- a total of 480 km -- experienced over 2 mo. Because the buoy moved into shallow water during early April, we assume the mooring had parted and was lost; however, we will probably know exactly why the mooring failed unless we are lucky enough to recover the "bitter end" of the mooring.

12D07 was deployed with a nylon-line inverse-catenary mooring which very possibly could have suffered a break due to chafing against the lake bottom or the flotation section could have risen close enough to the surface to have been cut on a section of ice due to wave action. In any event, when 12D07 was redeployed

Figure 23.-- Just a little more than a week after the previous photo. USCG PHOTO.

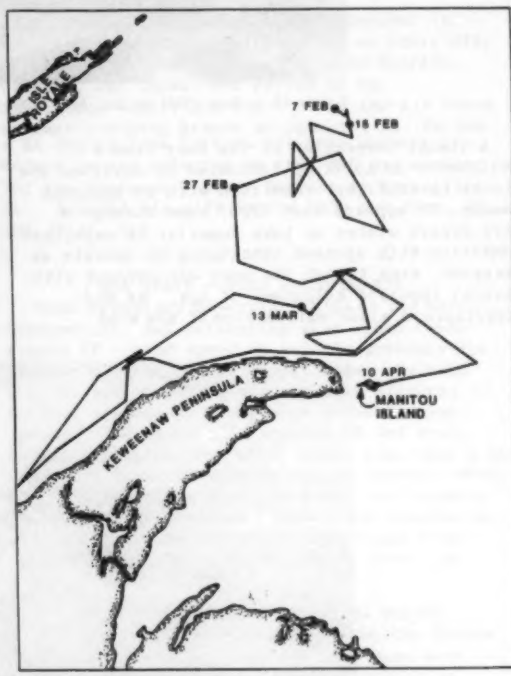


Figure 24.-- The movement of Buoy 45001.

this spring, we used an all-chain mooring to prevent a similar problem from recurring. This all-chain mooring will also provide a mooring system that is fairly easy to retrieve and redeploy.

Figure 25 was taken by a Coast Guard overflight on February 27 and shows very heavy ice accumulation on and around the buoy. Figure 26 was taken on March 13 as the buoy was starting its trek to the west-- just north of the Keweenaw Peninsula.

Figure 25.-- Buoy 45001 on ice, Feb. 27th. USCG PHOTO.

A visual inspection of the buoy from a helicopter on April 10 indicated it survived the winter in excellent condition with no apparent damage. It appears that 12D07 came through a very severe winter on Lake Superior in excellent condition with systems continuing to operate as designed, even though the buoy was covered with several thousand kilograms of ice. We did experience a minor malfunction of the wind direction systems prior to the onset of winter; however, this will be corrected and is not an uncommon problem with the buoy located at sites much more benign than Lake Superior in the winter. We have termed the experiment a success and will continue testing the concept for another winter prior to making any decisions concerning deployment of additional 12-meter "ice buoys" in the Great Lakes.

Figure 26.-- March 13,1986. USCG PHOTO.

Marine Observations Program

Martin S. Baron
National Weather Service
Silver Spring, Maryland

HOUSTON PMO INJURED

Julius Soileau, PMO in Houston, was seriously injured onboard the SAUDI MAKKAH on June 3. While he was walking toward the elevator, the ship's spreader bar fell, hitting him in the shoulder and knocking him down. The bar then fell on his legs, severing both above the ankles. We offer our heartfelt hopes and prayers to Julius and his family over this tragic event. After receiving treatment at Houston's Hermann Hospital, Julius is now resting at home. His address is 5911 W. Airport Road, Houston, Texas 77035.

NEW PMO IN SEATTLE

David Bakeman has been selected for the PMO position in Seattle, WA (fig.27). Dave has been with the National Weather Service for 30 yr working as an observer/forecaster at Tatoosh Is., Olympia and Quillayute, WA, Barrow, Yakutat, Cold Bay, and Annette, AK, Las Vegas, NV, Marcus Island, Limon, CO, Salt Lake City, UT and Lake Charles, LA. Dave completed emergency medical technician training while in Alaska and is an instructor for Red Cross first aid classes. He has also completed courses in meteorology, electronics, and mathematics at Fresno City College, University of Utah, University of Alaska, and the University of Nevada at Las Vegas. Dave and his wife Lorraine have five children, ranging in age from 15 to 28 yr.

Figure 27.-- New Seattle PMO, David Bakeman.

NEW PMO IN CHICAGO

Bob Collins has been appointed PMO in Chicago, IL. (fig.28). Bob came to work for the National Weather Service in 1983, after having served over 21 yr with the Air Force. While in the

Figure 28.-- New Chicago PMO, Don Collins.

service, he worked as a weather observer in Kansas City, Korea, Thailand, and at Scott AFB. IL. He was a weather forecaster in Florida, Okinawa, and Texas, and served as an instructor-supervisor for 4 yr in the Air Force weather training branch at Chanute, IL. He has a BA degree from Eastern Illinois University. Before he was selected as PMO, Bob was working for the National Weather Service in Marsellies, IL. Bob and his wife Sandra have two sons, 15 and 18 yr old.

SEA STATE - WIND SPEED CHARTS

Most Voluntary Observing Ships do not have anemometers, and estimating wind speed (code figure FF - wind speed in kn) is probably the hardest element in the ships' code. To help out, we are preparing a chart with pictures of various sea states along with probable wind speeds. The chart will contain 12 sea state pictures,ranging from wind speeds less than 1 kn (Beaufort force 0) to wind speeds between 56-63 kn (Beaufort force 11). We thank the Canadian Atmospheric Environment Service for loaning us the sea state photos, which were taken from Ocean Weather Station "P" several years ago.

NEW COASTAL WATERS REPORTING POLICY

All voluntary observing ships in the United States and Canadian programs have been sent letters advising them of the new reporting schedule within 200 mi of the United States and Canadian coastlines. The letter mailed to U.S. vessels is reproduced here. The 3-hr reports are of great value. The coastal zones often serve as breeding grounds for dangerous storms and many different human activities are in progress here. All weather reports are voluntary. Send 3-hr reports if you can. If this interferes with your shipboard routine, give highest priority to reports at the main synoptic times of 0000, 0600, 1200, and 1800 GMT.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Silver Spring, Md. 20910

July 31, 1986 W/OTS21x2:MSB

Dear Master, Mates, and Radio Officers:

This is to advise you of a new weather reporting policy now in effect in the coastal waters of the United States and Canada. When within 200 miles of the mainland coast and from the Great Lakes, the weather reporting times are now every three hours -- at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 GMT. This also applies to the waters within 200 miles of any of the Hawaiian Islands and to the Alaskan coastline.

The new reporting times will give you a greater opportunity to report from within the coastal zone. The synoptic times of 0000, 0600, 1200, and 1800 GMT continue to be the main and preferred weather reporting times. Reports at the intermediate standard times of 0300, 0900, 1500, and 2100 GMT are solicited as data in support of that provided at the main synoptic times.

If you are able, send us a weather report once every three hours from within the 200-mile coastal strip. When shipboard routine does not permit 3-hourly reports, give first priority to reports at the main synoptic times and second priority to reports at the intermediate standard times. All vessels should make an effort to transmit some data from coastal waters.

The United States and Canada have revised the coastal waters reporting schedule in order to meet the data requirements of weather forecasters in both countries. The increasing amount of nearshore human activity -- both commercial and recreational -- and the proximity of these areas to the largest population centers of our countries are placing greater demands upon our respective weather services. Storms affecting the shipping lanes or coastal cities often develop from within the coastal zone, making ship weather reports especially valuable from this zone.

There are no plans to amend the weather reporting schedule from other areas. Once you are beyond the 200-mile zone, you should return to the regular reporting schedule -- 4 times a day at the main synoptic times, and once every 3 hours when within 300 miles of a named tropical storm. Don't forget to send a special report whenever you encounter weather significantly worse than forecasted, using the prefix SPREP at the start of the weather message.

We thank you for your cooperation as Voluntary Observing Ships. Your weather reports continue to be the primary source of data from which all marine weather charts, weather forecasts, and storm warnings are prepared for everyone's benefit.

Sincerely yours,

Martin S. Baron
Voluntary Observing Ship
Program Manager

Tips to the Radio Officer

Julie L. Houston
National Weather Service, NOAA
Silver Spring, MD

Changes To Worldwide Marine Weather Broadcasts (Jan. 1985 Edition)

PAGE: 22
CHANGE: back (clockwise change in direction) to back (counterclockwise change in direction).

PAGE: 62
ADD: HZG Dammam to the Saudi Arabia Section.
HZH Jeddah to the Saudi Arabia Section.

PAGE: 77 - 79
ADD:
TIME: 0525, 1725
PRODUCT: W, S, F24
AREA: Arabian Gulf North of 26.5°N, Arabian Gulf South of 26.5°N including the strait of Hormiz and Gulf of Oman and Approaches.
FREQUENCY: 4185
SOURCE: HZG Dammam, Saudi Arabia

TIME: 0520, 1700
PRODUCT: W, S, F24
AREA: Arabian Gulf North of 26.5°N, Arabian Gulf South of 26.5°N including the strait of Hormiz and Gulf of Oman and Approaches.
FREQUENCY: 435
SOURCE: HZH, Jeddah, Saudi Arabia

TIME: 0630, 1830
PRODUCT: W, S, F24
AREA: Arabian Gulf North of 26.5°N, Arabian Gulf South of 26.5°N including the strait of Hormiz and Gulf of Oman and Approaches. Red Sea North of 20°N; Red Sea South of 20° North including the strait of Bab Al Mandab and Gulf of Aden and Approaches.
FREQUENCY: 8651, 12792
SOURCE: HZG Dammam, Saudi Arabia

PAGE: 98
ADD: Saudi Arabia
HZG Dammam
HZH Jeddah
Under the South Africa Section

TIME: 0533, 1733
PRODUCT: W, S, F24
AREA: Arabian Gulf North of 26.5°N, Arabian Gulf South of 26.5°N including the strait of Hormiz and Gulf of Oman and Approaches.
FREQUENCY: 1780, Ch 25
SOURCE: HZG Dammam, Saudi Arabia

TIME: 0503, 1703
PRODUCT: W, S, F24
AREA: Arabian Gulf North of 26.5°N, Arabian Gulf South of 26.5°N including the strait of Hormiz and Gulf of Oman and Approaches.
FREQUENCY: 1726, Ch 25
SOURCE: HZG Jeddah, Saudi Arabia

PAGE: 121

TIME: 0533, 1733
PRODUCT: W, S, F24
AREA: Arabian Gulf North of 26.5°N, Arabian Gulf South of 26.5°N including the strait of Hormiz and Gulf of Oman and Approaches.
FREQUENCY: 1780, Ch 25
SOURCE: HZG Dammam, Saudi Arabia

TIME: 0503, 1703
PRODUCT: W, S, F24
AREA: Arabian Gulf North of 26.5°N, Arabian Gulf South of 26.5°N including the strait of Hormiz and Gulf of Oman and Approaches.
FREQUENCY: 1726, Ch 25
SOURCE: HZG Jeddah, Saudi Arabia

The Editor's Desk

12 regions for better definition. In addition to the common elements, freezing spray and shipping weather have also been included. For example on northern Lake Superior in November the potential for moderate freezing spray occurs 5 percent of the time while good shipping weather is present just under 70 percent of the time; these terms are well defined in the introduction to this section.

The atlas is based primarily on ship observations which have been supplemented by buoys, satellite and aircraft. The period of record is 1951-1980.

This atlas has a place, not on my bookshelf, but on my desk as one of my most valuable references. For the Great Lakes mariner it deserves a place of importance. For the Great Lakes observer he can feel proud of his part in this publication.

NEW: Great Lakes Climatological Atlas

Editor: Andrej Saulesleja, Environment Canada, Toronto
Available: Canadian Publishing Centre, Supply and Services Canada, Ottawa, K1A 0S9,
Catalogue No. EN56-70/1986
Price: $11.95 (in Canada $9.95)

If you ever wonder just how much use your weather observation gets, don't worry. It gets plenty — even after its primary real-time function. A perfect example of this is a beautiful, important, low-priced atlas of the climatology for the Great Lakes. Published in both English and French this 145-pg guide is invaluable for anyone with an interest in the Great Lakes. Mariners, weekend sailors, yacht-clubs, power squadrons, marinas, shipping companies and marine insurance agencies are just some of the users that will find this publication helpful. It is the most extensive atlas of its kind and much of the information is presented for the first time anywhere. It covers both the American and Canadian portions of the Lakes.

The atlas is organized into two principal sections. In the first, the areal variation of climatic elements is presented in map form by month or season. These include air and water temperatures, winds, waves, visibilities, precipitation and cloud cover. Because of its importance, ice cover is depicted bi-weekly. In addition, wind and wave information is summarized by season in graphs for climatologically distinct areas. The second section shows, in graphic form, the monthly variation of climatic elements for each of the Great Lakes. The Lakes have been divided into

Weather Watch For Liberty Gala

Commerce Department's National Oceanic and Atmospheric Administration (NOAA) established a "weather watch" for New York City's 100th birthday celebration of the Statue of Liberty, July 3-6, to ensure the safety of more than two million visitiors and 45,000 vessels in New York harbor (cover).
The New York harbor was equipped with a special lightning detector, linked to the State University of New York's lightning detection network. Consolidated Edison of New York provided this unit for the event.

"Lightning and wind can be particularly dangerous with such a large concentration of people in open areas during the summer, when thunderstorms are frequent," said Richard E. Hallgren, director of the NOAA National Weather Service.

Center of weather service operations was at the National Weather Service Forecast Office in New York City. In addition to five-day general forecasts, this office issues thunderstorm outlooks, wind forecasts, and immediate warning or special statements on anticipated severe weather. All such information was provided to the U.S. Coast Guard and the New York City and New Jersey Police Departments for use in coordinating events.

Frequent updates of Coast Guard marine weather observations were broadcasted continuously over the NOAA Weather Radio, a system whose broadcasts can be monitored 24 hr a day. The observations covered the coastal area from southern New Jersey to eastern Long Island. A special weather station was set up in Liberty Park, N.J. to assist the New Jersey State Police Department, which had overall

responsibility for coordinating Liberty Day events, NOAA said.

NOAA's National Ocean Service, in commemoration of the centennial, has issued a special edition of three principal nautical charts of the New York harbor area. They may be purchased by contacting any NOAA chart sales facility or commercial charts sales supplier, the agency said.

Dial ● A ● Hurricane

East and Gulf Coast residents can call 900-410-NOAA for up-to-date information on tropical cyclones that may be threatening. West Coast residents should call 900-410-CANE. Both services cost $0.50 for the first minute and $0.35 for each additional minute. Non AT & T subscribers on all coasts may call 1-0-288-900.

Information recordings will be available after the National Weather Service has identified a hurricane or tropical storm during the hurricane season -- June 1 through Nov. 30. A typical tape will provide a storm's position, anticipated path, landfall predictions, windspeed, and tide effects.

Hotline information is provided by the weather service and underwritten by AT&T, NBC News and USA Today. The American Red Cross received $58,300 from funds generated by last year's calls.

Upper Wind Observation Key To Hurricane Movement

Scientists this year will provide forecasters with data collected during flights into and around off-shore storms to help give earlier hurricane warnings for coastal residents.

"Observations of winds at about 20,000 ft and within 500 to 600 mi of the center of a hurricane are crucial in determining its movements", Robert W. Burpee of the National Oceanic and Atmospheric Administration (NOAA) said.

Burpee, of NOAA's hurricane research division in Miami, has measured the environmental wind field NOAA research planes, over the past 3 yrs. These instruments sense data from flight level to the ocean surface and radio it back to the aircraft.

Forecasters at NOAA's National Hurricane Center in Coral Gables, Fla., receive data from the lower levels of the atmosphere, from surface observations aboard ships, and wind data from the motion of low clouds observed by satellites.

Data between 35,000 and 50,000 ft come from commercial aircraft navigation systems and from satellite observations of high cloud movement. Forecasters have only limited measurements for other levels where much of the hurricane steering action may occur.

The hurricane research division provides the information when the hurricanes are 36 hr or more from land, and when the forecast center must consider what coastal areas to warn. Estimates indicate that reducing 20 mi of coastline placed under hurricane warning would save about $3 million in preparedness and lost production costs.

Radiosonde Returns Realize Revenue

What would you think if you saw a white box, attached to a bright red parachute, float into the courtyard of a federal building?

That's the dilemma that faced a Washington, D.C. street vendor recently when just such an object dropped into a courtyard at the U.S. Treasury Department. He called the guards, who examined it and found it to be a radionsonde, a weather-sensing device released earlier that day from Dulles Airport.

It was one of about 100,000 a year launched by the National Weather Service from various parts of the U.S. and the Caribbean, to send temperature, wind, humidity and pressure data back to launch sites. From there, the information goes to the National Meteorological Center near Washington.

When the radiosonde balloons burst at altitudes up to 20 mi, their instruments parachute to earth. Those that are found are reconditioned and returned to the air by NOAA for about half the price of a new instrument package (fig. 29).

Over the Commerce Department agency's 40-yr upper air observation program, more than $10 million has been saved by the recovery, reconditioning and reuse of the balloon-borne radiosondes.

Recently, the return rate began declining, prompting a national awareness campaign. In the current drive, approximately $30,000 has been saved since January and 1100 more radiosondes than normally expected -- a 13 percent increase -- have been salvaged.

Figure 29.-- Anyone find one at sea?

MARINE WEATHER REVIEW

The Weather Logs combined with the cyclone tracks, U.S. Ocean Buoy climatological data, gale and wave tables, and mean pressure patterns are a definitive report on the weather systems and primary storms which affected the North Atlantic and North Pacific Oceans during this 3-mo period. Hurricane Alley lists and describes tropical cyclones worldwide. Unless stated otherwise, all winds are sustained winds and not gusts; all times are G.M.T.

North Atlantic Weather Log
January, February and March 1986

WEATHER LOG, JANUARY 1986 -- Cyclonic activity over water tended to be concentrated between the northeast U.S. coast and Baffin Bay and from southeastern Greenland to the Baltic Sea. This above normal activity can be partially blamed on the persistence and extent of the Azores - Bermuda High. The high at this time of the year is usually centered west of Morocco with a 1020 mb pressure and very little gradient. Even in July a 1022 mb center is located near 30°N, 40°W and it dominates most of the North Atlantic. However this month a 1034-mb center (fig.30) was located near 35°N, 30°W and the high dominated most of the North Atlantic south of 50°N. This high was composed of several HIGHs that moved eastward from the Plains of the U.S. along with several strong Canadian systems.

The resultant, abnormally high pressure over the North Atlantic shunted many storms north of the normal paths and also maintained a tight pressure gradient along the northern shipping lanes. The Icelandic Low was near its normal position and 8 mb lower than normal. This dip plus the tight gradient resulted in a windy, stormy month along the northern shipping lanes. In addition the concentration of storms in the Greenland and Baltic Seas was reflected in pressure anomalies of -14 mb and -11 mb respectively.

The influence of the tremendous Azores - Bermuda High was seen even at the 700 mb level, where the center was sitting over 32°N, 30°W with a 150 m anomaly. This tightened the normal zonal gradient into a strong east northeasterly flow between the U.S. and Europe.

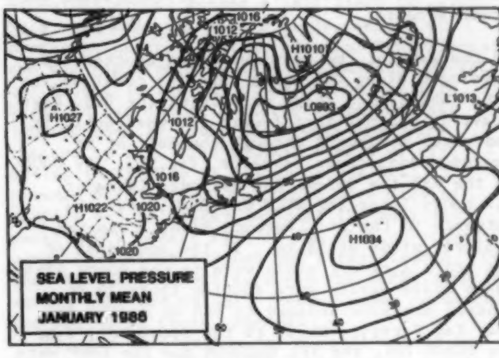


Figure 30.-- January Mean Sea Level Pressure.

Extratropical Weather -- The month began with an intense LOW that had formed in December and was now roaming the mid North Atlantic, generating gales in the southwest quadrant. Even at this time a large 1034-mb HIGH was centered near 30°N, 25°W and another one was moving in from the west to reinforce it. This set the tone for the month as several LOWs made their way northeastward along the New England Coast and through the Canadian Maritime Provinces before moving south of Greenland. For the first half of the month the most familiar picture on the charts was a HIGH to the south and several LOWs between Greenland and the North Sea. About mid month several systems made their way into the Baltic and one swept through the northern Mediterranean. The LOW that moved through the North Sea on the 14th brought heavy weather to Northern Iceland and caused extensive coastal damage. The weather featured hurricane force winds, rain, hail and even snow; one area reported 12 in of rain. The Irish Sea ferry service was disrupted for 2 days. Another LOW was sweeping into the Labrador Sea. During the second half of the month high pressure continued to dominate the weather south of 45°N forcing storms into the Norwegian and North Seas. Oslo was affected by lows on the 19th, 21st, 23d and 26th. Several others made their way into the Denmark St. during that period.

On This Date -- Jan. 18, 1817 -- A luminous snow storm in New England produced occurrences of St. Elmos Fire as static discharges on roof peaks, fence posts, and even fingertips. Jan. 25, 1821 -- The Hudson River was frozen solid as the region suffered through its coldest winter in 41 yr. Thousands crossed the ice from New York City to New Jersey and refreshment taverns were set up in the middle of the river to warm pedestrians.

This storm was spawned on the 3d off the mid Atlantic coast, although its origins can be traced back to a system that had originated in the Pacific, off British Columbia. Paralleling the New England coast the LOW deepened rapidly. By 1200 on the 5th central pressure was estimated at 976 mb east of Labrador and 40-to 50-kn winds were being reported in southern and southwestern quadrants. A day earlier, in the Northumberland St. the SIR WILLIAM ALEXANDER encountered northerly winds at 68 kn, possibly due to local intensification. More representative were reports from the TFL DEMOCRACY which was encountering 45-to 50-kn westerlies in 12-to 13-ft seas and 13-to 18-ft swells. A radio report from the DIKSONE, well south of the center, at 0000 on the 6th indicated estimated 85-kn winds. The system however was beginning to fill as it tracked east northeastward.

In the wake of the previous storm another LOW developed along the South Carolina coast on the 4th. While this storm paralleled the U.S. East Coast it did not turn toward the east until it had moved northward through the Gulf of St Lawrence and across Labrador (fig.31). By 0000 on the 7th the 962-mb LOW was over Labrador. Six hours later the GULF GATINEAU, near the entrance to the St. Lawrence River, reported westerly winds at 58 kn. To the southeast of the storm's center winds were in the 40-to 45-kn range while swells were running 15 to 20 ft. Central pressure dropped to 960 mb on the 8th near Kap Farvel. Ships to the southwest, like the SEDCO 709, the TFL FREEDOM and the KMHF were reporting 50-to 55-kn winds. The storm began to fill as it moved toward the east southeast.

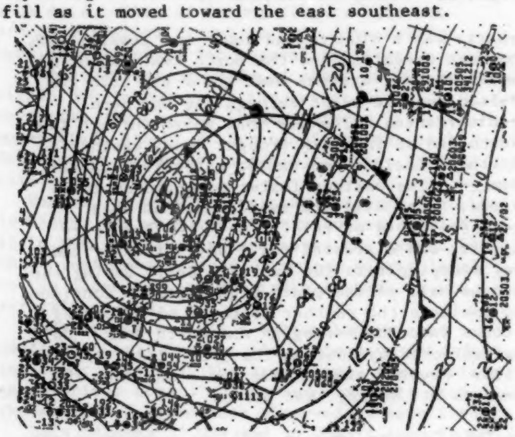


Figure 31.-- LOW at 0000 on Jan. 7th.

On the 8th a LOW developed along a front near 37°N, 67°W. Moving northeastward it intensified slowly. By midday on the 9th central pressure was down to 972 mb and 40-kn winds were being reported to the southwest, behind the associated cold front. Temperature drops associated with the frontal passage were on the order of 10°C. On the 10th at 0000 the FNZZ encountered 50-kn winds in 20-ft swells near 44°N, 34°W, more than 600 mi southwest of the 962-mb center. His temperature was 40°C while some 600 mi to the southeast the KAFF measured the air at 25°C in 45-kn southwesterlies. The LOW was accelerating. By 1200 its center was just southeast of Iceland and down to 952 mb. Winds of 40 to 45 kn were common throughout its southern semicircle. Seas to the south were ranging from about 15 to 30 ft. The NEFTEKAMSK near 54°N, 17°W ran into 50-kn storm-force winds in 20-ft swells. The SERENIA and the SEAGAIR off the coast of Norway, west of Bergen, reported 75-and 70-kn winds respectively. Central pressure dropped to about 944 mb early on the 11th as the storm moved into the Norwegian Sea (fig.32). Winds of 68 kn were reported by both the EYRARFOSS and the DISARFELL. On the 12th the LOW, slowly weakening, moved into Norway.

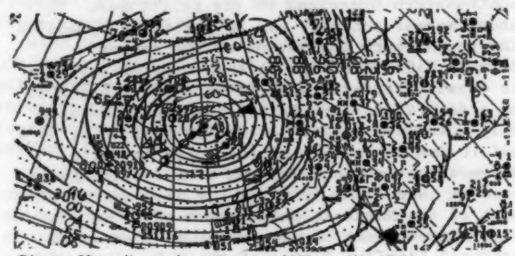


Figure 32.-- Norwegian storm at 1200 on the 11th.

A storm that originated on the coast of British Columbia on the 8th wound up affecting shipping in the North Sea and Norwegian Sea on the 13th and 14th. One of the first indications that this LOW had taken a turn for the worst occurred at 1200 on the 13th when the PACIFIC CHALLENGE encountered 49-kn winds in 30-ft swells a few hundred mi southeast of the center. At the same time the NEFTEKAMSK reported 62-kn winds in 22-ft swells. The 944-mb center was just south of Iceland at this time. Slowly filling it headed northeastward into the North Sea and continued to generate storm force winds through the 14th. At 1200 the highest reported winds were around 70 kn from the GOULBINIE and the FARO.

At mid month a LOW that had come to life off Cape Hatteras was winding up off the Labrador coast. A double center combined on the 16th and created gales across the western North Atlantic shipping routes. Its effects were felt as far south as 38°N (60°W) where the AMERICAN EXPRESS encountered 40-kn winds. Farther north, east of Newfoundland, the SEDCO 710, BOW DRILL I and the VCNP all reported winds of 60 kn or more. At 0000 on the 16th the FRITHJOF reported in with 61-kn measured winds in 15-ft seas near 45°N, 49°W. The LOW continued past Kap Farvel and across Iceland but weakened considerably during its travel.

On the 21st a LOW popped up southwest of Iceland and began to cause considerable discomfort along the northern shipping lanes. The OYDX just west of Iceland at 0000 reported northerly 60-kn winds. A tight gradient ahead of the system was creating storm force winds in the North Sea as well. This was attested to by the MAERSK ANGUS, who reported 50-kn southerlies. To the south of the 962-mb center at 1200 winds were in the 50-to 60-kn range and due to a long fetch, swells were running 30 to 40 ft. The AUSTANGER, ATLANTIC CONVEYOR and DART AMERICANA were among the vessels encountering these conditions. The system persisted as the center made its way through the Norwegian Sea on the 23d (fig.33). Winds of 45 to 55 kn continued to plague vessels in the eastern North Atlantic as well as ships and rigs in the North Sea. The storm remained a powerhouse as it moved across Norway and Sweden. Its effects were felt into the Mediterranean. At 1200 on the 24th, Menorca reported 45-kn northwesterlies following a frontal passage.

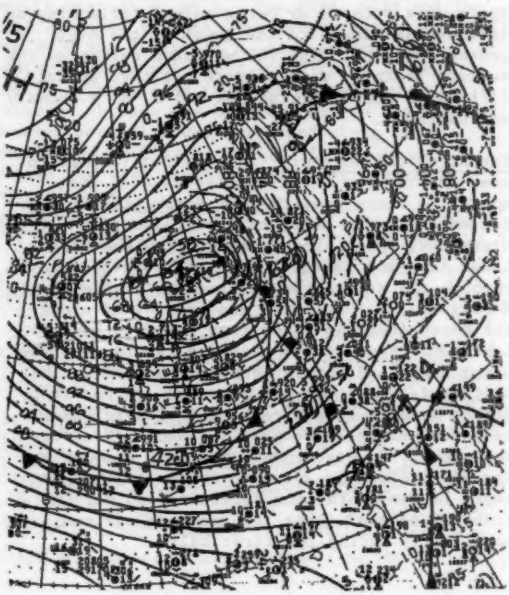


Figure 33.-- Large storm dominates the Norwegian and Greenland Seas at 0000 on the 23d.

A short-lived storm formed just west of Iceland on the 26th. It hung around long enough to cause some weather problems over the northern shipping lanes. The JOHAN PETERSEN near 58°N, 36°W at 1200 on the 26th encountered 60-kn winds in 30-ft seas. The LOW moved across Iceland on the 27th (fig.34). At 1800 on the 28th the ANTWERPEN near 48°N, 26°W measured 74-kn winds in 30-ft seas. The storm began to fill on the 29th although the gradient between it and a large 1048-mb HIGH to the southwest kept winds above gale force over a small portion of the mid North Atlantic.

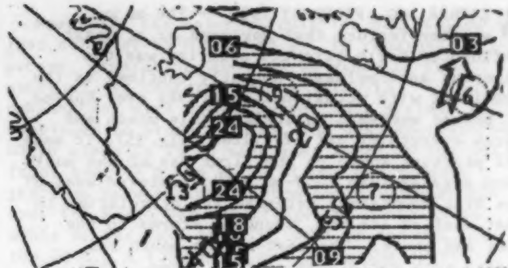


Figure 34.-- Waves (heights in ft) generated by storm at 0000 on the 27th.

<u>Casualties</u>-- January was a rough month for shipping in the North Atlantic. There were several reported sinkings. On the 7th the SALVATORE AIELLO sprang a leak after being hit by a huge wave in force 8 winds some 20 mi northeast of the Italian island of Pontelleria; she was reported sinking. The CASTILLO DE SALAS off Gijon, in the Bay of Biscay on the 11th, broke in two during a fierce storm and lost 100,000 tons of coal; the 32-man crew were rescued by tug. The LUCHANA sank 6 mi off Aviles in the Bay of Biscay on the 1st; 23 crewmen were rescued but three were missing. In another Bay of Biscay incident the American yacht UNDER REPAIR sank on the 29th in stormy seas. The BREMEN rescued her three crewmen. On the 30th in the Mediterranean the ALPRO sank in stormy seas off Malaga. Rescue teams recovered the bodies of three crewmen.

Fog was responsible for a collision on the 4th between the BEATRINES, which sank, and the ORANGE CORAL in the River Elbe and on the 10th between the CAVIMA, which sank, and the bulk carrier KOZNITSA in Kiel Bight. A snowstorm was blamed for another collison on the Elbe between the WAYLINK and BRADY MARIA on the 4th. In the Bay of Eleusis (Greece) all hell broke loose on the 17th. Violent squalls gusting to force 9 swept across the Saronic Gulf area and ships broke moorings and were colliding and running aground all over the place. The tug PERSEUS sank as did the AGIOS NIKOLAOS. A few of those that broke loose and collided include the SEA LION, ODYSSEU, EMMA METHENITIS, KIMOLOS and the MARIANNA. Even a Canadian firefighting plane had to make a forced landing in the bay.

On the 24th off the English coast of Norfolk the ORLEANS, carrying 73 thousand tons of crude, collided in stormy seas with the JAN VAN TOON. All were rescued in 10-ft swells and 50-kn gusts. Groundings during the month included the RIO GRANDE (14th) off Scheveningen, the RIGA off Rotterdam and the JIMMY in Rouen Channel.
On the 9th the MIRANDA ran aground on Miami Beach in heavy surf and on the 19th the RUBENS grounded in strong winds in the River Scheldt. Among those suffering heavy weather damage were the ARZANAH, the HYMETUS, the ALEXANDRA M. I and the GALINI. The LEONA from Baltimore to Montreal suffered ice damage to her propeller, on the 25th.

WEATHER LOG, FEBRUARY 1986 -- The major weather feature that governed or at least influenced North Atlantic activity was the Siberian Anticyclone. Normally confined to the continent with occasional outbreaks over Europe, it pushed westward to Iceland this month and threw everything out of kilter (fig.35). It made its pressure known on the first day of the month when a gargantuan 1059-mb HIGH, centered west of the Ural Mountains, extended its circulation to just east of Iceland, shunting storms to the west and south. The rest of the month was pretty much variations on this theme. This situation provided relief, from a stormy January, to the Norwegian Sea, North Sea and Baltic Sea as well as the surrounding land masses. Although strange, it was a familiar pattern to see a 1030-to 1040-mb HIGH centered over Iceland, the British Isles, Scandinavia and the Denmark Strait.

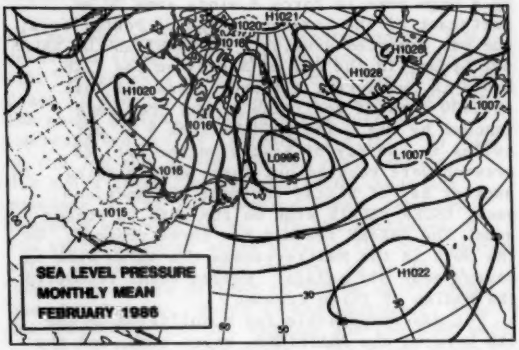


Figure 35.-- February Mean Sea Level Pressure.

Of course since you usually don't get something for nothing there was a price to pay for the relatively calm conditions in the region. The most obvious was a lack of precipitation in the United Kingdom and throughout Scandinavia. Departures ran about 1 to 5 in (30 to 139mm) below normal. Bergen, which normally records about 5.4 in (138.9mm) came in with 0.3in (7.6mm). Stavanger was down about 2.1 in (54.9mm) while London had a 1.4 in (34.9mm) deficit. The other, less obvious, penalty was the temperature, as cold continental air consistently overspread the region. In coastal areas where mean temperatures range from near freezing (0°C) to the low 40's (6°C) readings were off by 4° to 9°F (2° to 5°C). For example the mean in London (Gatwick) was 30°F (-1.0°C) which is about 9°F (5.1°C) below normal. At Kent, F.G. Thomas in a letter to the British Journal of Meteorology relates an incident of one cold snap on Feb. 9th: "Returning churchgoers said they had never felt it as cold on a Sunday evening. They were right because it was only one degree C warmer than the exceptional - 13.0°C (8.6°F) recorded here at down on the 17th January 1985..." His minimum for the night was -15.4°C (4.3°F).

The sustained cold weather brought thick ice which halted northern German canal traffic and hindered coastal shipping. The Mittelland Canal linking Berlin with the Ruhr and the Elbe-Seiten Canal, connecting Braunschweig with the Elbe, below Hamburg, were frozen to a depth of 33cm (13in). Most of the Dortmond-Ems Canal was also iced up. Attempts to keep the canals open with icebreakers were abandoned pending an improvement in the month-long freeze. Pack ice restricted shipping on the Elbe approaches to Hamburg and most of the Baltic Sea area bordered by West and East Germany and Denmark. Temperatutes dropped to -28°C (-18°F) in some parts of Schleswig - Holstein.
The Icelandic Low, normally centered just south of the Denmark Strait was forced southwestward to the Labrador Sea. The squeezing of the storm tracks into this area produced a - 11 mb anomaly This anomaly also reflected a tight pressure gradient that resulted in a large number of gale reports, particularly in the Grand Banks region. Low pressure centers in the Mediterranean, off Spain were 8 to 10 mb below normal reflecting an increase in storms to the south of the high pressure region. The 700 mb chart reflected the surface features with a large positive anomaly (171 m) in the Norwegian Sea and a -89 m anomaly off Labrador.

Extratropical Weather -- A tipoff of things to come occurred on the first few days of the month. A storm from the mid North Atlantic was forced northward onto the east coast of Greenland, while another moved from the Great Lakes into the Labrador Sea and two others moved through the Mediterranean, leaving a hole in the Norwegian Sea. Activity was consistent along the North American Coast from the Carolinas to Labrador. Four storms passed directly over the Grand Banks and several others produced weather in that region. The low pressure systems that didn't move in that direction in general moved east northeastward between 35° and 50°N across the ocean. Several ended up moving through the Bay of Biscay. In addition to the two storms early in the month, the Mediterranean was the scene of several other low pressure systems, particuarly during the first half.

On This Date -- Feb. 7,1978 -- One of the worst winter storms in history struck coastal New England. It produced 27 in of snow at Boston and nearly 50 in in northwestern Rhode Island. The 14-ft tide at Portland ME was probably the highest of the century. Winds gusted to 79 mph at Boston and 92 mph at Chatham MA. Hurricane size surf caused 75 deaths and $500 million damage. At sea a 600-ft oil tanker was blown aground off Salem. In a desparate rescue attempt four brave men in the pilot boat CAN DO went out to investigate. Seas of 30 ft smashed their vessel in near zero visibility. The boat sank and all four were killed.

The ESSO PICARDIE discovered the first real storm of the month early on the 6th when she reported in with 57-kn northerlies in the Gulf of St. Lawrence. This was confirmed at 0600 when the JOHN A. MACDONALD encountered 65-kn winds nearby. This LOW had come to life on the 4th right along the Virginia Capes. By 1200 on the 6th its 977-mb center was just east of Newfoundland. The rigs BOW DRILL I, SEDCO 710 and the VCNP, all reported southeasterlies at about 45 to 47 kn, southeast of the storm center at 1200. The DES GROSEILLIERS had a 57-kn encounter at 1800. The system continued toward the Labrador Sea, and on the 7th, the central pressure dipped to 968 mb (fig. 36). Winds among the drilling platforms on the Grand Banks were running 45 to 55 kn but were now coming out of the west. At 1200 in addition to the reliable platform reports a host of moving vessel observations came in. Winds ranged from about 45 to 61 kn. Among those reporting were the VINLAND with 61-kn easterlies in 23-ft swells near 46°N, 48°W. The VCNP, CG29 and the VSBB all came in with 50-kn westerlies. At 1800 the HOOD NO. 3 near 44°N, 42°W encountered westerly winds estimated at 70 kn in 20-ft swells. The system remained intense as it recurved through the Labrador Sea on the 8th. However several waves developed along an associated cold front on the 7th and these became the real trouble-makers for the next several days.

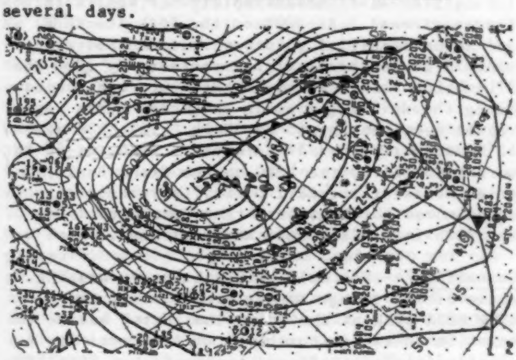


Figure 36.-- Grand Banks storm at 1200 on the 7th.

The first wave didn't look like much but its frontal system packed a wallop. The MEERKATZE sailing near 54°N, 26°W on the 8th encountered southeasterlies of 56 kn and 57 kn at 0000 and 0600 respectively in seas that were running about 22 to 25ft. This system quickly fizzled but was replaced by another. This second wave generated some very strong winds ahead of its front along the 15° to 30°W longitude band between about 40° and 65°N on the 10th. The GAVANA at 0000 near 56°N, 23°W west reported a south wind at 81 kn. Usually this might be considered a transmission error except that 6hr later the ALAFOSS (63°N, 19°W) reported a 64-kn wind out of the east southeast. Other ships were reporting winds in the 45-to 60-kn range.

Meanwhile the major circulation had stalled just north of 55°N near 43°W. It remained potent, generating 30-to 40-kn winds to the south of its center. On the 11th, in conjunction with a third wave, this system continued to produce gales. The DARU encountered 40-kn winds in 23-ft seas just ahead of the cold front near 48°N, 26°W. A strong north-south gradient between this system and a 1038-mb HIGH over the North Sea was triggering 50-to 55-kn winds as far east as 11°W, west of the U.K. on the 12th. A long fetch was producing 30-ft swells as well. The intensity of this situation was documented by reports from the NURA ITTUK, and the DE HOOP. The following day this system weakened as it made its way into the Denmark Strait.

About the time the previous system stalled north of 55°N, on the 10th, a LOW formed as a wave along a front in the Gulf of Mexico. It redeveloped twice before finally getting it together east of the Delmarva Peninsula on the 11th. By the 13th central pressure had dropped to 968 mb and gale reports started to roll in. Once again those Grand Banks drilling rigs were caught in 45-to 50-kn winds; the SEDCO 710, VSBS and VNCP remained the reliable rigs. Near 49°N, 43°W the CANMAR AMBASSADOR was nailed by 60-kn winds in freezing drizzle. At 1800 the PACIFIC COURAGE measured west winds at 57 kn in 33-ft seas about 350 mi south of the storm's center. The followind day the STUTTGART EXPRESS (47°N, 33°W) ran into 52-kn westerlies while fighting 33-ft swells. The 964-mb center continued northeastward on the 14th. The DARU caught in the previous storm had a real battle with this one. At 1200 on the 13th she reported in with 48-kn southwesterlies in 25-ft seas. Six hr later her winds had increased to 60 kn in 35-ft swells; pressure was measured at 982 mb. By 0000 on the 14th winds dropped to 50 kn from the west in 32-ft swells, while pressure rose to 992 mb. Other vessels were not immune either, as the INCOTRANS SPIRIT with 52-kn winds in 23-ft seas and the ATLANTIC CONCERT with 58-kn winds in 14-ft swells battled the storm. The storm began to weaken on the 15th and recurve after it crossed 55°N. By the 16th it had stalled and was stagnating.

During mid month North Atlantic weather was dominated by two storms (fig. 37). The European bound LOW came to life on the 14th near 36°N, 61°W while the following day the Grand Banks LOW was spotted south of Nova Scotia. For the next week gale and storm force wind reports were abundant. On the 15th the TFL EXPRESS encountered 6 hr of very rough weather amidst the frontal zone south of the European storm. At 1200 near 40°N, 34°W she estimated west winds at 70 kn in 49-ft swells, with a 980 mb pressure. Visibility was 50 yd in blowing spray. Nearby the LUDWIGSHAFEN EXPRESS hit 62-kn winds in 30-ft swells while the STONEWALL JACKSON stood before 65-kn westerlies also with 30-ft swells. The TFL EXPRESS, with excellent observations in

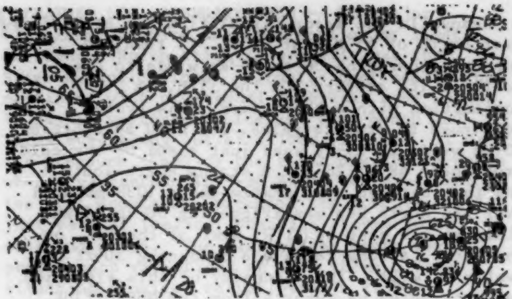


Figure 37.-- Incipient storm is seen at top left, while European LOW is more noticeable.

very trying circumstances, was the closest to the center. At 1500 her winds dropped to 60 kn and seas were estimated at 41 ft. Three hr later they were down to 55 kn; seas were running 36 ft with swells estimated at 44 ft. This was one strong storm. During the 16th central pressure dropped to 962 mb as the storm headed toward the Bay of Biscay. Winds from ships caught within the circulation ranged from 50 to 60 kn while swell was running 30 to 50 ft. Many of the reports contained measured winds. The ships that provided these observations included the SEALAND ADVENTURER, SEAS BRASIL, TEMSE, MELTON CHALLENGER, HEINRICH HEINE and PACIFIC UNIVERSAL.

Meanwhile to the west the Grand Banks storm was winding up as pressure dropped to 976 mb in its center which was off Cape Race. Winds to the east and south were running 40 to 50 kn while seas were in the 15-to-25 ft range. At 1800 on the 16th the BARRYDALE ran into 58-kn southerlies in 33-ft seas near 43°N, 47°W. By 1200 on the 17th central pressure had dropped to 960 mb as the storm neared 55°N and began a turn to the south. The TFL ADAMS, DARU, SEDCO 710, and the VCNP all reported in with about 45-to-55-kn winds in seas ranging from 15 to 30 ft. This storm began to fill on the 18th, about the time the European LOW began moving across the south of France. This storm was also weakening but traversed the northern Mediterranean and eastern Europe while the Grand Banks storm meandered between 55° and 60°N as it filled.

This long-lived storm began near the Chesapeake Bay on the 18th and ended up off the coast of Portugal some 9 days later. A report on the 20th by the VESALIUS, which measured 48-kn winds with a 990-mb pressure, gave an early warning that this was a storm to be reckoned with. Central pressure was estimated at 978 mb at 1200 on the 20th; 24hr later it hit bottom at 964 mb after crossing the 45th parallel just east of 40°W. Just east of the center at this time, the CEDYNIA encountered 50-kn southwesterlies; 6hr later her winds were up to 52 kn from the west. The 15,107-ton ATLANTIC SERVICE had her hands full on the 21st and 22d. Heading eastward just south of the center, she measured west southwest to west winds at 54 to 56 kn during a 15-hr period (fig. 38). Swells were running about 30 ft and on her 0900 observation seas were estimated at 36 ft. Her pressure had dropped to 976 mb at 1800 on the 21st while visibility dropped to 0.5 mi in blowing spray. The KYPU and TAURIA encountered winds between 50 and 55 kn the 22d. The following day the storm began to weaken and turn toward the east southeast. On the 24th the ATLANTIC SERVICE battled the system once again as she ran into winds of more than 45 kn in 15-ft seas off Brest. The storm slowed and continued to weaken as it dipped southward on the 26th.

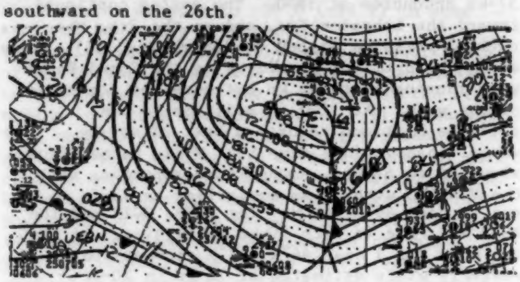


Figure 38.-- 964-mb LOW at 0000 on the 22d.

On the 25th along a frontal wave well east of Charleston SC a LOW developed. This storm intensified as it moved rapidly northwestward then northward. At 0000 on the 26th the KMHF and an unidentified ship both encountered winds near 50 kn southeast of the center. By 1200 the 971-mb LOW was in the Cabot St. Once again winds among the drilling rigs in the Grand Banks region were running 45 to 50 kn. The ELDA near 42°N, 65°W reported 54-kn winds. Winds of 50 kn were reported by the VSBC on the Grand Banks. After crossing the Gulf of St. Lawrence the storm moved northwestward then northward. On the 28th it stalled just south of Ungava Bay.

Casualties -- The Gulf of St. Lawrence was the scene of ice damage to the propeller of the ANDROMEDA STAR on the 2d as the vessel became beset in thick ice northwest of Anticosti Is. A similar fate was suffered by the tanker TENHYAKU on the 24th in the Gulf. In the Mediterranean area the MATTERHORN lost a port anchor at Suez outer anchorage area on the 5th due to heavy weather with 40-kn winds. Farther north in the Agean Sea the crew of the RABUNION III was rescued on the 7th after the vessel hit a reef west of Lesvos Is. A few days later (11th) in the Adriatic the tanker BATIS was discharging crude oil near Rijeka when she was exposed to 80-kn wind gusts. Ropes parted and the Master had to shift the vessel to anchorage to save it and the cargo. That same day the UNITY II sank off the western coast of Greece in heavy weather; all nine crewman were lost. Across the Atlantic on the 11th the LINDSEY FRANK and DUA MAR collided in a snowstorm in the Kill van Kull between Bayone, NJ and Staten Is, NY; visibility was reported to be less than 0.1 mi.

Meanwhile the AMISIA sustained ice damage the same day on passage from Atangen to Sondeled, Norway. Heavy weather off Spain and Portugal on the 16th and 17th produced a number of mishaps. The KRITI PERIDOT, from Hamburg to Jeddah, sustained damage as did the RUBENS from Hamburg to Valparaiso. A tragedy occurred when the CHARNECA and the tug PALENCA were sent to salve the MANSFELD which had engine problems in the Berlenga area. The CHARNECA was smashed into the outer breakwater wall of Leixoes port and broke in two; there was only one survivor among the eight man crew. The MANSFELD ended up stranded on the rocks.

Around the 15th the SEACROSS suffered heavy weather damage from Yenbo (Red Sea) to New York as did the STONEWALL JACKSON from Suez to Newport News. In the worst tragedy of the month the SNEKKAR ARCTIC sank in heavy seas, with gales west of the Outer Hebrides, on the 21st. Rescuers hampered by gales and snow showers plucked nine of the 23-man crew from the waters. One of the crewman from the stern trawler DOGGER BANK fell overboard while pulling survivors from the sea. A few days later, the STERN caught in an easterly gale grounded on a Great Yarmouth beach.

WEATHER LOG, MARCH 1986 -- This could be known as the month of the Icelandic Low or why I wouldn't care to work on a North Sea Oil rig. As in January the most influential feature was the establishment of a strong Azores-Bermuda High (fig.39), continuously replenished by HIGHs sweeping down from Alaska and Canada. This ridge, which was 13 mb above normal, was centered north of its usual position and forced the extratropical storms north of their normal haunts. The result was an intensification and elongation of the Icelandic Low. It was about 20 mb above normal in the Denmark St and off Kap Farvel. Over northern Greenland where high pressure usually edges in the departure was -25 mb. Residents of Iceland as well as fishermen and workers on drilling rigs on the Grand Banks and in the North Sea could testify that this was a stormy month. One look at the storm tracks will tell you they would be right. This pattern was supported at the 700 mb level by a strong east northeastward flow with indications of both the Azores High and Icelandic Low.

Extratropical Weather -- The month began with what was to be a familiar pattern -- a LOW moving over the Grand Banks with a 1032-mb HIGH to the southeast. Through the month about eight storms moved close enough to the Grand Banks to generate rough weather. Most of them originated off the mid Atlantic coast of the U.S., although several came by way of the Great Lakes region. After the Grand Banks tour many of the systems headed northeastward or, by a little more devious route, to Iceland. From there it was on to the Greenland or Norwegian Seas. The Norwegian and North Seas were besieged by a number of short-lived storms during the last 10 days of the month as March went out like a lion in these parts. Just how bad was it? In the United Kingdom on the 24th hurricane force winds, snow and sleet left on trail of havoc and destruction. Some of the worst winds in 50 yr battered coastal areas in the South and West Country with gusts up to 85 kn being recorded. France also experienced the so-called 50-yr storm as strong winds and driving rain uprooted trees, ripped off roofs and caused havoc in general.

Across the Atlantic on the 25th and 26th strong southwesterly winds carried unseasonably warm air across the Ohio Valley into New England. Wind gusts in the Great Lakes region were running 20 to 50 mph while a gust of 63 mph was clocked at Cleveland shortly after 1pm EST. Temperatures were in the 70's (°F) across the southern Great Lakes.

In the Mediterranean several storms were sighted during the first two weeks with little activity thereafter.

On This Date -- March 2, 1846 -- A great storm struck Virginia and the Carolinas. The storm caused $.5 million damage. On Notts Is, NC 50 families and one thousand head of cattle were drowned.

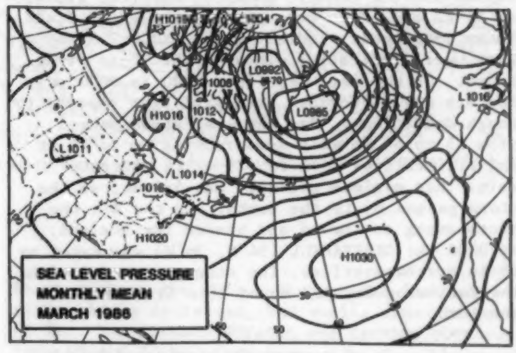


Figure 39.-- March Mean Sea Level Pressure.

At 1800 on the 2d the BDHE measured 60-kn south southwesterlies near 42°N, 58°W in 30-ft swells with visibility reduced to 50 yd in heavy rain. This was associated with a LOW that had formed along a front the day before and was the first indication of how potent this system had become. In addition it was moving rapidly northeastward, crossing the Grand Banks early on the 3d. Reports from ships and rigs in the vicinity indicated winds in the 45-to 60-kn range; such reliable reporters as the VINLAND and SEDCO 710 were on the scene. By the 4th the 962-mb LOW was approaching Iceland and the following day central pressure was down to 952 mb as it entered the Norwegian Sea (fig. 40). The OSV L, at 0000 on the 5th, reported 50-kn westerlies in 30-ft swells some 400 mi south of the storm's center, while the WALTHER HERWIG encountered

62-kn westerlies a little farther to the north. On the 6th the storm began to fill as it turned northward.

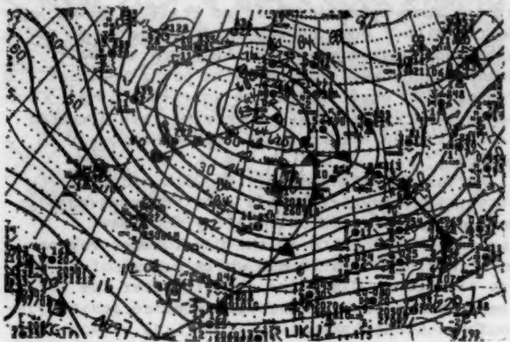


Figure 40.-- 962-mb center just south of Iceland at 1200 on the 4th.

This powerhouse developed east of Cape Hatteras on the 5th — about 180mi west of the previous storm. Its path was also similar, although it reached its lowest pressure of 963 mb, near 55°N, south of where the previous storm dipped to 956 mb. On the 7th two Russian vessels, the MUSSON and the GEORGIY USHAKOV, reported winds of 54 kn and 52 kn respectively while the Grand Banks contingent, including the SEDCO 710 and VCNP, were indicating winds in the 45-to 50-kn range. On the same date from 1500 to 0000 on the 8th OSV C provided series of 3-hr reports in rough conditions. Her measured winds ranged from 45 to 64 kn with seas running up to 46 ft and visibilities down to .25 mi in moderate rain. Her minimum pressure was 968 mb, as the storm passed by to the north. On the 8th the storm swung northward and headed for Iceland. At 0000 the SKAFTAFELL (54°N, 36°W) was raked by 68-kn northwesterlies. The storm crossed Iceland the following day and moved into Greenland on the 10th.

It wasn't much of a storm in a meteorological sense but don't tell that to the crews of the CALANDA who experienced 52-kn winds in 33-ft swells or the SCOL BROKER with 55-kn winds in 16-ft seas at 1200 on the 11th. The LOW had come to life some 12 hr earlier near 50°N, 39°W. While the storm's central pressure was at 976 mb at 1200, a 1029-mb HIGH to the southwest created a tight pressure gradient and a good long fetch from the northwest. These conditions resulted in gales and rough seas in the waters between the two opposing systems. The PASSAT, on the 12th and 13th, ran into 47-to 50-kn winds in 30-to 33-ft swells as it crossed the storm's wake. The storm turned a partial counterclockwise loop on the 14th and stalled.

While the previous system was creating some problems in mid ocean a storm that had developed over the Great Lakes region, on the 10th, was speeding across the Gulf of St. Lawrence in order to keep things hopping on the Grand Banks. By 1200 on the 12th a rash of reports from that area indicated winds were around 48 to 56 kn and seas were in the 20-ft range. Among the ships and rigs reporting were the SEDCO 710, ALEKSANDR NEVSKIY, KHARLOVKA, BESTRASHNKY, and VCNP. On the 13th the 968-mb LOW had crossed 55°N near 32°W and turned northward. It was less than 600 mi southeast of the previous storm's center. The following day it moved through the Denmark St. AT 1200 on the 14th Hofn i Hornafirdi, Iceland recorded a 50-kn southwest wind. This system became stationary along with the previous system and the two combined to generate gales and rough seas for several days over the Norwegian and North Seas. Ships and rigs were reporting winds in the 45-to 60-kn range with swells running 15-to 25-ft on the 14th. At 0900 the FARO near 59°N, 1°W reported southerlies at 58 kn. The LAGARFOSS at 1200 on the 15th was still encountering 52-kn southerlies near 61°N, 11°W

Another Iceland bound storm came to life over South Carolina on the 14th. It began as a wave along a stationary front but really didn't get it together until the 17th. By this time the 968-mb LOW had already crossed the 30th meridian near 50°N. It was also turning northward. The LAZAREV (48°N, 14°W) southwest of the storm's center early of the 17th, encountered 54-kn winds, while the KOLPINO at 1200 hit 62-kn southerlies in 16-ft seas close to the center. Also close to the center but on the west side the BRIDGEWATER encountered 60-kn winds from the northwest in 13-ft seas. Several other vessels were encountering 20-ft seas, southeast and southwest of the center. Later in the day a vessel called the YUOZAS VAREYKIS estimated winds of 70 kn near 51°N, 33°W. She was riding 13-ft seas at the time. This storm cruised across Iceland on the 18th to reinforce the weakening centers from the previous two storms. This infusion was enough to bring several more days of rough weather to the Norwegian and North Seas. For Iceland this month was beginning to sound like a broken record. The DNFF off the Outer Hebrides ran into a 64-kn hurricane force blow on the 20th at 0900. Seas were running at 30 ft. The FARO (59°N, 1°W) at 2100 measured 65-kn westerlies in 36-ft swells. Finally on the 21st the system began to subside and was forced aside by another storm from the south.

The 20th proved to be one of the roughest days of the month for shipping and drilling rigs in the Norwegian and North Seas.

A LOW that had developed on the 16th some 300 mi east of the Virginia Capes had slipped quietly across the Atlantic. On the 19th as it crossed the 50th parallel near 25°W its central pressure read 992 mb. By the 20th pressure had dropped to 974 mb and the storm was encompassed in a huge circulation that contained centers of the previous two systems. This complex situation resulted in a flood of gale reports from the oil fields of the North and Norwegian Seas. At 1200

some 34 observations were radioed in containing winds that ranged from 45 to 65 kn. Seas were running up to 40 ft. This barrage of observations continued throughout the day. At 1800 the DRUPA near 61°N, 2°E was laboring in 33-ft seas while battling 64-kn south southeasterlies. Among the other ships fighting this treacherous weather, yet still having time to report, were the SEAGAIR, NORTHIA, MAERSK ANGUS, MATCO AVON, MATCO THAMES, and the NEFTEKAMSK. The LOW regained its own identity and crossed the 75th parallel early on the 22d.

On the 24th a LOW came to life on the Grand Banks. Heading northeastward it intensified and by 1200 on the 26th was a 960-mb storm spreading gales and rough seas throughout its southwest quadrant. Storm winds of 55 to 60 kn were being received from the CALANDA, TRAVEL ORE, ABITIBI MACADO and the JO LONN. The JO LONN was running in 40-ft swells. At OSV C (52.7°N, 35.5°W) winds increased from 41 kn at 1200 to 48 kn at 1800 to 52 kn at 0000 on the 27th. During the same period, waves increased from 16 to 40 ft. Her peak reported winds were measured at 56

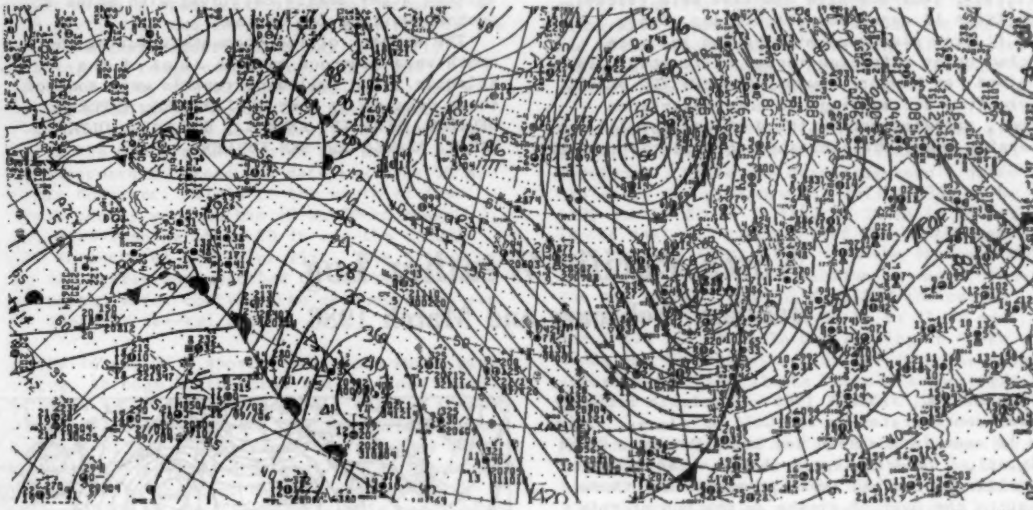


Figure 41.-- At 1200 on the 24th the potent North Sea storm and the newly formed Grand Banks LOW can be seen in a complex situation.

Toward the end of the north a complex situation developed, which involved the formation and dissipation of several short-lived storms in the Norwegian and North Seas. The most identifiable of these LOWs was one that was discovered in the North Sea at 1200 on the 24th (fig.41). This rapidly developing system had a 965-mb center on first analysis. At 0900 the TAURIA confirmed the severity of this storm by reporting 55-kn winds in 33-ft swells southwest of the storm's center near the Bay of Biscay. Closer to home several vessels and drilling rigs were reporting 45-to 60-kn winds. However most of the action was to the south and southwest. At 0000 on the 25th the CHARLES ROWAN near 53°N, 3°E ran into 56-kn northwesterlies in 13-ft seas. The drilling platforms off southern Norway were reporting 40-to 60-kn winds throughout this rough day. The storm moved into Norway and then northward across Sweden late on the 25th and early on the 26th. However conditions remained rough as several smaller lows rushed in to take its place through the end of this interminable month.

kn at 2100 on the 26th. Through the 27th her winds slowly decreased, but swells remained near 40 ft. The SEALAND VOYAGER and RAINBOW HOPE ran into 48-and 50-kn winds respectively. The RAINBOW HOPE was fighting 44-ft swells. By the 28th the storm was weakening and swinging northward toward the Norwegian Sea, where gales had been blowing for a week or more.

Casualties -- On the 4th, 2 mi off the coast of Mexico and about one-half mi south of the mouth of the Rio Grande a local squall sank 15 Mexican shark fishing vessels. Dense fog resulted in an accident to the SORMOVSKIY 118 while leaving Copenhagen on the 11th and to the AMERICAN NEW JERSEY on the 14th in New York, where she ran aground resulting in $1 million in damages plus chartering costs. Also on that date the CELYA collided with the PIARAEUS ROADS in bad weather in the Saronic Gulf. On the 20th the ELSE GITTE ran aground on the south end of Little Cumbrae Island, Firth of Clyde in hurricane-force gusts of up to 80 kn.

The fierce North Sea storm on the 24th-26th resulted in a rash of accidents. In the worst the roll-on roll-off cargo vessel KARELIA in the Baltic Sea was forced to seek shelter northeast Gotska Sandon. The 14-yr old ship developed a list and was driven aground. The 15 crewmen abandoned the vessel in a liferaft. Of these 11 were winched to a helicopter but two died later from exposure. The four remaining seamen died in the liferaft before a rescue attempt was made. On the 25th the AMINA sank about 15 mi off Ile Vierge near L'Aberwrac'h, north coast of Brittany; four men died and five were rescued. The ERICA II sank 90mi off Ribadeo, Spain. Of the 11 crew nine were missing and two were picked up by a Spanish rescue helicopter. In England, at Newport, Gwent, the MONTEGO BAY II broke from her moorings in hurricane-force winds, careened across the dock and toppled a quayside crane which crashed through the roof of an empty banana wharehouse. Also on the 24th 11 men on a North Sea gas rig were airlifted to safety after the SELLEBRUNN drifted close to them in stormy seas. The ship had lost power. Also a drilling rig -- the semi-submersible SANTFE RIG 140 -- was being towed from the Mediteranean to Scotland when it got caught in the storm off France. The line to the tug SMIT SINGAPORE parted in hurricane-force winds and 50-ft seas. It drifted about 11 mi until the storm subsided. The GRAND FELICITY, laid up at Gijon since August 1985, broke lines and ran aground after nearly colliding with ships at anchor, waiting for berths.

The number of ice encounters during the month were numerous on both sides of the Atlantic. The following vessels were some of these damaged by ice; BUTJADINGEN, IMPERIAL BEDFORD, LIMA II, ANKE S., EDELGARD, OLYMPIC DREAM, AZALEA and SAN EDUARDO.

North Pacific Weather Log

January, February and March 1986

WEATHER LOG, JANUARY 1986 -- Cyclonic activity was concentrated in the Gulf of Alaska. This can be seen in the Mean Sea Level Pressure Chart (fig.42), and the track charts as well as anomalies in the sea level pressure. All these point to the Gulf of Alaska as the hub of this months cyclonic activity. This resulted in a major shift in the position of the Aleutian Low, which is normally centered southeast of the Kamchatka Peninsula with a weak secondary center in the Gulf. Even pressure in the primary region was below normal by about 4 mb, but this was minor compared to the 21-mb drop in the Alaskan Gulf.

This large Aleutian Low, whose influence extended to south of 30°N, combined with abnormally high pressure over the western U.S. to produce a tight gradient along the northwestern North American Coast. The North Pacific subtropical high was squeezed eastward of its normal position although the central pressure remained near normal. The western half of the North Pacific lacked any sort of pressure gradient except in the Bering Sea. Adding to the tight pressure gradients in this region was a strong 1034-mb high in the Arctic Ocean.

The influence of the Aleutian Low in the Gulf of Alaska was reflected at the 700 mb level where it was centered just southeast of the Alaska Peninsula with a -197 m anomaly . South of 45°N the flow was strictly zonal to the west of 150°W. To the east this gradient swept northeastward around this upper low in the Gulf.

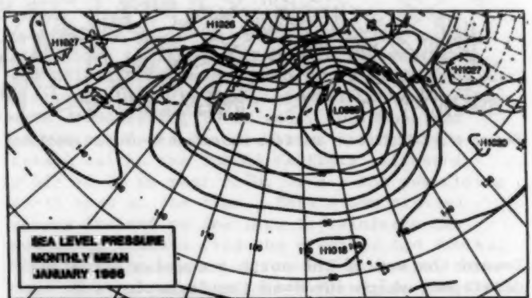


Figure 42.-- January Mean Sea Level Pressure.

Extratropical Weather -- Appropriately the month began with a LOW moving into the Gulf of Alaska, which was shortly followed by another more intense, but short-lived system. This set the pattern for the month. During the first half of the month several systems moved through the Sea of Japan. A few from the south recurved into the northern North Pacific and western Bering Sea, east of the Kamchatka Peninsula, during the second half of the month. However the most typical pattern remained storms from the south and southwest moving northeastward into the Gulf of Alaska where they either recurved toward the north or continued onto the coast of British Columbia. The west coast of the U.S. was particularly vulnerable during the second half. On the 17th winds gusted to more than 60 kn at Hoguian WA and Astoria OR and to around 50 kn at Olympia, Tacoma and Whidbey Is, Wa. On the 22d another system spread rain and strong winds along the northern Pacific Coast. Cape Blanco,

OR recorded a gust to 72 kn. On the 31st, based upon ship reports of winds gusting to more than 50 kn a high wind watch was issued for the Oregon Coast.

On This Date -- Jan 6, 1880 -- Seattle WA was in the midst of their worst snowstorm ever. After the storm, 4ft of snow covered the ground. Hundreds of barns were destroyed and transportation was brought to a standstill.

The months first storm developed from a double center along a front that stretched across a good portion of the central North Pacific on the 1st. The easternmost system was initially creating the rough conditions. This was testified to by the SHINANO MARU (44°N, 164°W) and the PLANTIN (53°N, 146°W); both reported 58-kn winds in 16-to 18-ft swells at 0000. By the 2d the western LOW, which had moved northeastward to cross the dateline near 50°N, became dominant. Winds to the south of its 976-mb center were in the 40-to 50-kn range, seas were running 15 to 20 ft and the SURUGA MARU encountered swells of 25ft. The following day the system was absorbed by another LOW to the north, which continued to produce rough sea for the next several days.

On the 2d and 3d a short-lived storm swung past Peking, through North Korea and out into the Sea of Japan. It influence was felt only on the 4th by the QUATSINO SOUND and SEALAND EXPLORER when measured 47 and 49 kn respectively. They were approximately 800 mi northeast of the center and caught in the gradient between the LOW and a 1034-mb HIGH to the southeast. This resulted in swells around 30ft. Late in the day the storm moved across the Sakhalin Peninsula.

The second in a series of rapidly deepening, rapidly dissipating lows to move through the Gulf of Alaska popped up on the 5th near 47°N, 162°W. It didn't really get organized until 0000 on the 7th when the center deepened to 956 mb near 52°N, 142°W a drop of about 36 mb in just 12 hr (fig.43). Several ships got caught by this sudden turn of events. The HAKONE MARU (50°N, 141°W) was clobbered by 65-kn winds as was the EXXON PHILADELPHIA (54°N, 143°W). which was rolling in 30-ft swells. Top honors go to the ARCO TEXAS, however, at 1800 near 55°N, 137°W when she measured 69-kn winds in 44-ft seas. The EXXON PHILADELPHIA had the lowest pressure with a reading of 957 mb. The highest seas were being reported east and northeast of the storm's center and readings in the 30-to 40-ft range were common and included MOBILE MERIDIAN (33-ft seas), the ATIGUN PASS (30-ft swells) and the POTOMAC TRADER (30-ft swells), which also reported 60 kn. By the 8th the storm had moved ashore and by 1200 central pressure was back up to 986 mb. However in its wake was another short-lived storm.

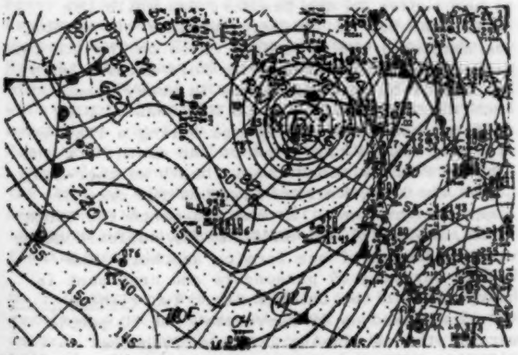


Figure 43.-- The Gulf of Alaska at 1200 on the 7th.

This LOW was first spotted on the 7th some 250 mi northeast of where the previous storm developed. While its deepening wasn't quite as explosive the pressure did fall to 968 mb by 1200 on the 8th -- a fall of 25 mb in 24 hr. To the east and southeast of the center seas were running 15 to 20 ft. On the 9th over WBH 29-Kodiak, Peggy Dyson received a report from the ALL ALASKAN near 53°N, 130°W indicating southeasterlies at 45 to 50 kn in 22 ft seas. The EXXON PHILADELPHIA was sailing in 45-kn winds and 20-ft swells. On the 10th the storm recurved over the Alaska Peninsula and began to fill.

Continuing the saga of the rapidly deepening Gulf of Alaska systems, this LOW can be traced back to the 8th near 35°N, 158°E. However the effects on shipping seemed minimal until about the 11th when reports of 40-to 50-kn winds began trickling in. The 966-mb LOW and crossed the 45th parallel near 152°W and was beginning a now familiar swing through the Gulf of Alaska. The KORDUN at 1200, near 33°N, 163°W, was plowing through 15-ft seas in 50-kn winds. The central pressure had fallen to 958 mb. The SHINANO MARU NO. 308, DONG WON and the BADGER were among the ships that provided evidence to forecasters of this potent system. Along with a center that had intruded into the circulation from the south on the 12th the storm controlled the weather over the entire Gulf of Alaska and south to about 30°N. At 0000 the TOKYO RAINBOW (34°N, 146°W) was caught in 25-ft swells with a stiff 45-kn breeze. However she was luckier than the WORLDSTAD (55°N, 163°W) which took time to radio WBH 29 that she was fighting light freezing spray in 18-ft swells whipped by 50-kn winds, with a 25°F temperature reading. Gradually the original center gave way to the LOW from the south, which continued through the Gulf for the next several days. On the 14th the STACY FOSS (59°N, 143°W) encountered 24-ft swells in 45-to-55-kn winds while nearby the JOSHUA estimated winds gusting to 60 kn in 22-ft swells. The YAPPA near 53°N, 147°W reported 64-kn winds in 25-ft swells late on the 14th. This second system hung around until the 16th.

Action in the western North Pacific was triggered by a LOW that originated near the Russian-Chinese border, north of Vladivostok, on the 12th. The storm swung southeastward across northern Japan and began to make waves (bad pun) on the 14th. At 1200 the 974-mb center was located near 43°N, 150°E. At this time the ANNIVERSARY THISTLE, NOVIGRAD and the NOVOLADOJSKY reported 60-50- and 45-kn winds respectively. At 1200 on the 15th the VERRAZANO BRIDGE reported 45-kn winds some 700 mi south of the center while the TATEKAWA MARU, about 480 mi south of the 979-mb center, encountered 56-kn winds. The system continued to fill as it recurved toward the northwest, but gales were being reported to the south on the 16th.

This long-lived storm began on the 16th south of Honshu. On the 18th the center regenerated at 1200 near 35°N, 175°E; pressure fell to 978 mb. The KORDUN (31°N, 165°E) encountered 55-kn winds in 20-ft swells while the NICHIRIN MARU fought 47-kn winds in 22-ft swells nearby. Winds of 40 to 50 kn continued to be reported as the system headed northeastward. By 0000 on the 19th the 964-mb center had crossed the 40th parallel near 175°W and was being lured into the Gulf of Alaska. The SETO MARU (38°N, 174°W) and the AMERICAN CALIFORNIA (31°N, 174°W) measured 49 and 45 kn respectively, both in 30-ft swells. On the 20th, sporting a 960-mb central pressure, the system moved into the Gulf. Early on the 21st the BEAUTEOUS (50°N, 137°W) and the TOMEI MARU (53°N, 144°W) reported 46-kn and 47-kn winds respectively. On the 22d the center slowed and weakened near 54°N, 155°W.

Another Gulf of Alaska bound storm sprung up on the 19th just south of where the previous system started. It provided little excitement until the 23d after crossing the 160°W meridian near 38°N. However there might be some argument from the AMERICAN MARKETER., who encountered 45-kn winds at 0600 on the 22d near 33°N, 175°W. An interesting report was filed by the YAFFA at 0000 on the 23d. She observed west southwesterly winds at 78 kn in squalls and wave heights were 22 ft near 43°N, 148°W. Six hr later the YAFFA was reporting 72-kn westerlies in showers with westerly swell heights running about 25 ft (fig44). During this period the air temperature dropped from 4.2°C to just below 0°C. The LOW was turning northward by the 24th but was not deepening. The chart on the 25th indicated a double center as the system continued its northward push. By the 27th the weakening system was stalled in the northern Gulf of Alaska.

This storm came to life south of Tokyo on the 21st. On the 22d it was part of a complex circulation that contained three or four centers and stretched from mainland China to the dateline. It wasn't until midday on the 23d that the situation was resolved and a clear cut identity was established for this 968-mb system that was now roaming the seas east of the Kuril

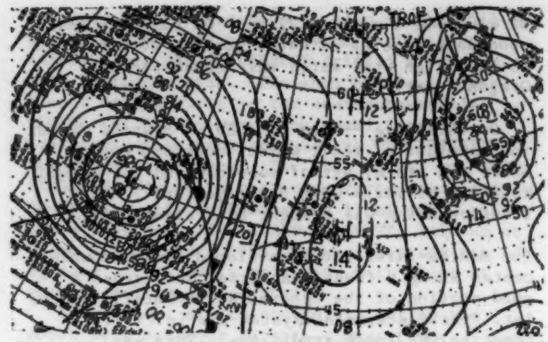


Figure 44.-- Two North Pacific trouble-makers at 0000 on the 24th.

Islands. The CORNUCOPIA, near 50°N, 177°E, was hit by 47-kn southerlies while laboring in 30-ft swells. The HYUNDAI PACIFIC reported 49-kn west southwesterlies near 43°N, 146°E at 0000. Continuing to deepen the LOW was turning northward; central pressure dropped to 950 mb by 1200 on the 24th. Winds of 40 to 50 kn were common within 300 mi of the center. This was confirmed by measurements from the EASTERN FRIENDSHIP, TOYOTA MARU 10 and ARCTIC TOKYO. These vessels were riding seas and swells in the 30-ft range on this date. The SEAHAWK sailing about 180 mi south of the center provided a graphic description of the storms power. For 9 hr, from 2100 on the 23d until 0600 on the 24th she battled winds that ranged from 45 to 53 kn in 15-to 22-ft seas. Her pressure varied from 968 to 977 mb. She provided excellent continuity during a difficult period (fig44). After crossing the 55th parallel near 170°E on the 25th the storm finally began to wind down. On the 26th she butted up against the Kamchatka Peninsula and came to rest.

<u>Casualties</u> -- A spare propeller broke loose on the ARCO PRUDHOE BAY, in rough seas between Honolulu and Valdez, on the 6th and caused damage to a cargo of pipes. That same day the KALVIK, an icebreaking tug, suffered ice damage to her rudder in the Beaufort Sea while the SHOKO MARU No. 58, in heavy weather off Kyushu, was abandoned and grounded. Also on the 6th the HARMAC DAWN had to return to Port Alberni when her timber cargo broke loose in heavy seas. Both the NATIONAL HONOR and NATIONAL DIGNITY suffered heavy weather damage during a Pacific crossing around this time of the month. On the 8th the PEDDLER foundered in heavy weather near Lapu-Lapu City, Kaubian Is., but the crew of eight were rescued. Around mid month the OGDEN YUKON, ALWASITTI and HAWAIIAN SEA suffered heavy weather damage of one form or another. The VENNAS carrying 69 passengers and crew sank in heavy seas in the Celebes Sea. Two fishing vessels picked up 19 survivors, but 50 people were listed as missing. On the 24th the KAKUHISA MARU entering Kanazawa, Japan as a port of refuge in rough weather, heavy snow and poor visibilities ran aground.

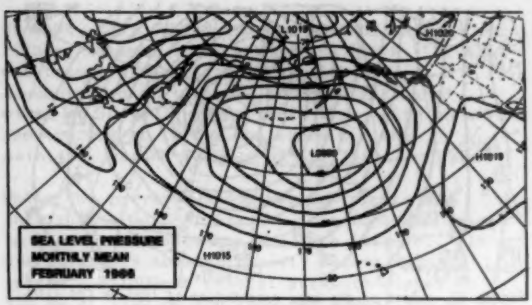


Figure 45.-- February Mean Sea Level Pressure.

WEATHER LOG, FEBRUARY 1986 -- As usual the dominant feature im the North Pacific this month was the Aleutian Low. However it was much more dominant than normal and centered farther south (fig.45). The circulation effectively controlled the weather from Japan to the West Coast, while a positive 20-mb anomaly reflected the preponderance of storms that moved across the mid Pacific. The subtropical high was near normal but just a little east of its usual position. The deep Aleutian Low was reflected at the 700 mb level where a -218 m anomally turned up near 40°N, 160°W. The flow at this level was mainly zonal from Japan to about 160°W between 20° and 40°N. East of 160°W it became a northeastward flow into the Gulf of Alaska and toward the West Coast of the U.S.

Extratropical Weather — A Gulf of Alaska storm started things off continuing the trend from the previous month. However, fortunately for that region, storms were less severe and less plentiful in the Gulf this month. The second storm was more typical as many of the systems began near Japan. Several, including the second one, recurved in the mid Pacific and turned back toward Asia. Several storms did move through the Gulf of Alaska, mainly either early or late in the month. Around the middle of the month a week-long series of low pressure systems rolled across the western U.S. bringing rough surf, heavy rains and snow that triggered mudslides, avalanches, and floods throughout California, western Nevada, Utah, Idaho, Montana, Colorado, Wyoming. At least 16 people died and three were missing. Hardest hit was northern California with up to 22 in of rain and 9ft of snow in the mountains. British Columbia, Oregon and Washington also suffered during this barrage. Late in the month a number of storms moved into the Gulf of Alaska generating strong winds and heavy seas which combined with low temperatures to cause some superstructure icing problems to fishing vessels.

On This Date — Feb 5, 1887 -- San Francisco received 4 in of snow which set not only a 24-hr record, but a monthly record as well. In the hills in the western sections of the city up to 7 in was recorded. People went beserk and a snowball throwing rampage ensued.

The anemometer aboard the SANKO CAMPANULA, near 43°N, 141°W at 0400 on the 1st, registered 67 kn from 250°. Outside 35-ft swells were slapping at the vessel. The weather was being generated by a storm whose 930-mb center was still more than 700 mi to the southwest. A few hours earlied the CHARLOTTE LYKES some 300 mi southwest of the center bucked 36-ft swells in 45-kn winds. By the 2d this short-lived storm had slowed and swung northward and its center filled to 980 mb. It ended up the following day moving across Vancouver Is.

Out of a conglomeration of weak LOWs that spanned the entire North Pacific on the 3d came one of the months more interesting storms. Its first real impact on shipping came at 0000 on the 4th when the BI JIN, ZIM MONTREAL, STAR KANDA, ORIENTAL EXECUTIVE and HOJIN MARU all encountered winds in the 45-to 55-kn range. Topping these was the TOYOTA MARU NO.16 with east southeast winds at 63 kn near 37°N, 174°W. This intensity was confirmed on the 5th at 0600 when the KASINA (46°N, 164°W) measured 60-kn winds with spray from 33-ft swells reducing visibility to 200 yd; 3hr earlier she reported a 962.5-mb pressure. By this time it had become apparent that this system was recurving (fig.46).

Central pressure fell to 946 mb at 1200 on the 6th as the system continued to generate gale force winds and rough seas. On the 7th the CONTINENTAL HIGHWAY and 3 EYO both encountered 45-kn winds west of the center where swells were running about 20 ft. By this time the storm was heading westward. It had also weakened slightly but central pressure was still at 963 mb by 0000 on the 8th. Its circulation extended from the Kamchatka Peninsula to the west coast of North America. The MOBIL MERIDIAN (60°N, 146°W) ran into a 65-kn east southeasterly in 33-ft swells. The storm then dipped southward and stalled for more than 24 hr. It finally got moving again on the 11th but weakened as it headed toward the west southwest. On the 14th it crossed the Kamchatka Peninsula.

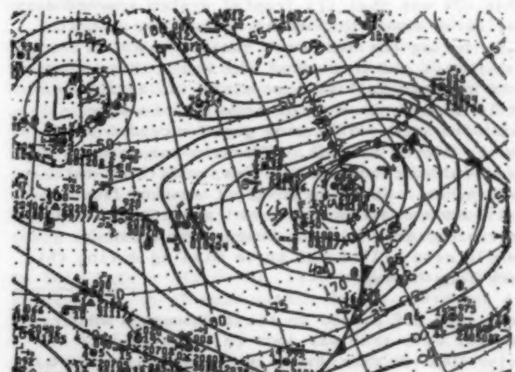


Figure 46.-- The 956-mb LOW south of the Aleutians.

A copycat storm formed on the 7th, just south of 30°N near 145°E. Its track was similar to the previous system and its lifetime exceeded one week. The HYUNDAI #7 first encountered this system near 34°N, 176°E early on the 8th when she measured 55-kn winds in 33-ft seas. Violent rain showers kept visibilities to 200 yd. On the 10th just south of the storm's center at 0000 she reported a 978-mb pressure with 49-kn winds; 6 hr later winds were up to 54 kn from the northwest in 41-ft seas. The MING OCEAN a little farther south was wallowing in 30-ft seas which were whipped by 46-kn northwestlies. The storm continued to intensify as it headed toward the east northeast. On the 11th the 964-mb center began to recurve northward. The ALAMEDA ran into 47-kn easterlies on the 11th, which increased to 52 kn the following day, all the time battling 33-ft seas. By the 12th the storm, which was beginning to fill, had completed its turn and was steaming toward the west northwest. The PERENNIAL ACE ran into southerly 54-kn winds near 47°N, 160°W at 1800 on the 13th. The weakening system hung on until the 16th when it moved across the Kamchatka Peninsula.

While the previous storm was recurving toward the north another LOW was coming to life in its wake on the 11th. Its impact was first felt on the 13th. The MEDLLOYD AMERSFOORT battled this storm for 6 hr, beginning at 1200. Her winds ranged from 56 to 59 kn in seas that ran about 30 ft. During the 13th the 966-mb storm began to turn northward and weaken. The MAUI (25°N, 145°W) at 1800 battled 21-ft seas in 48-kn winds; there was still some punch left. However the following day pressure in the center rose to 976 mb and the storm continued to fill.

On the 14th the previous storm was overtaken by another LOW to the south. This new system paralleled the northwest U.S. coast on the 14th and 15th before moving inland over Vancouver Is. on the 16th. However the real importance of this LOW was that its frontal system spawned a series of waves that moved across the western U.S. during the next week causing havoc in California and throughout the West. More than a foot of rain fell in some areas in California, while as much as 9 ft of snow fell in some mountain areas while wind gusts exceeded 85 kn in the Sierra Nevadas. The rain and snow resulted in floods rockslides, mudslides and avalanches. Waves up to 12 ft smashed the California coast and at least nine people had to be rescued from sinking boats. At least 16 people were killed and three missing during this week long barrage.

From just off Kyushu on the 14th came a weak frontal wave that was soon to organize into a major LOW. Within 3 days its central pressure had plunged to 960 mb while its circulation was more than 1000 mi in diameter (fig.47). In addition it was on one of those parabolic tracks that were so popular this month. The TRITON

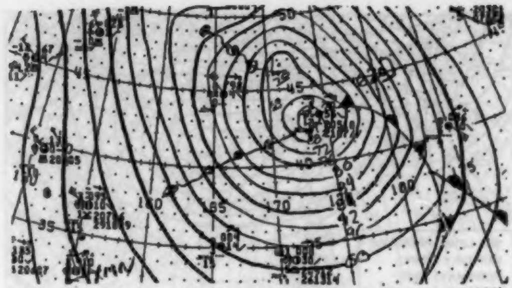


Figure 47.-- Part of the huge circulation at 1200 on the 17th.

sent in two excellent observations that pegged this storm for what it was. At 0200 and 0600 on the 16th near 33°N, 146°E she measured 65-kn winds in seas that increased from 36 to 44 ft. The following day the MARGARET LYKES hit 50-kn westerlies while battling 33-ft swells near 35°N, 168°E. On the 18th the system finished recurving and headed westward. While it was weakening the SEALAND MARINER in 30-ft seas measured 50-kn winds about 200 mi northeast of the center.

This system caused the most problems from the 16th to the 18th. On the 16th the HBZQ near 31°N, 150°E encountered 55-kn northerlies and measured a 987-mb pressure. The next day the AMERICAN LARK, HO-YU, 3EPZ and STOR recorded 45-to 58-kn winds with seas running 15 to 23 ft. That same day the STAR EVERACE encountered 45-kn winds in 33-ft seas while the 3EPZ reported 50-kn winds in 20-ft seas. Early on the 18th the GLORIOUS ACE, SEALAND MARINER and YOUNG KWANG ran into 50-to 55-kn winds; the Sealand vessel also reported 30-ft seas.

Even on the 19th the storm continued to generate gales and seas were running 15 to 20 ft throughout the southern semicircle. Finally a system to the south began to intensify and took over as the dominant circulation on the 20th.

This LOW originated over Kyushu on the 18th and gobbled up the previous system by the 20th. It became a real threat on the 22d at 0000 when its central pressure dropped to 960 mb after crossing 175°W near 40°N. Winds of 40 to 50 kn were common west and south of the center. The ASIAN HIGHWAY 600 mi to the south, at 0300, battled 33-ft swells in measured 53-kn winds. Valuable storm reports continued from this vessel through the day. The GLOBAL SPLENDOUR with 50 kn in 20-ft seas also reported in. The storm turned northeastward and headed for the Gulf of Alaska. At 1200 on the 23d central pressure was still at 962 mb. Later the NEPTUNE IVORY (41°N, 165°W) reported 46-kn westerlies amidst 23-ft swells. The following day the ZEELANDIA (53°N 166°W) was battered by 33-ft swells in 45-kn northerlies. The 974-mb system was approaching the Gulf of Alaska, where a secondary center was already producing some gales, snow and icing. These conditions were reported over WBH -29 Kodiak by the ALL ALASKAN,

SEAHAWK, CAPT JULIAN and the DOMINON among other fishing vessels. The AGNES FOSS (56°N, 157°W) was reporting freezing spray with an accumulation of 1 in per hr. She estimated winds at 50 to 70 kn in 16-ft seas, with an air temperature of 14°F. The storm hit the mainland, around Yakutat on the 26th.

While the previous storm was making its way through the Gulf of Alaska, this LOW was coming to life to the south on the 25th (fig.48). It was a rapidly moving, rapidly intensifying system. A 1002-mb central pressure dipped to 970 mb at 1200 on the 26th and was at 968 mb 24 hr later. To the east of its center, on the 27th, the CHARLES LYKES ran into 35-ft swells in 45-kn winds while the CHEVRON MISSISSIPPI in 33-ft swells measured 55-kn winds. The following day as the storm weakened the CHEVRON MISSISSIPPI was still measuring 45-kn winds and fighting swells of 45 ft.

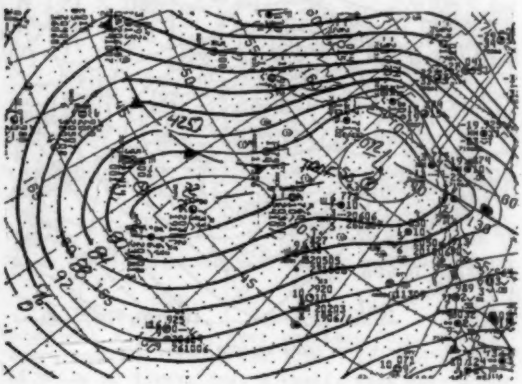


Figure 48.-- Old and new storms at 0000 on the 25th.

Casualties -- The KENZO MARU laden with 300 tons of sand during a voyage in dense fog touched seabed near Ohtsu, Vokosuka on the 11th. The vessel capsized and submerged. The skipper died. Earlier, on the 6th the SEIZAN MARU collided with the TENYO MARU, near 34°N, 131°E, in poor visibility during snowy weather. On the 8th the PAUL BUCK sustained propeller damage in ice. Around mid month the barge MLC - 310 broke up in Bolinas Bay due to heavy weather, while the VIENNA WOOD N suffered heavy weather damage on the 16th and 17th bound for Osaka. The container vessel NEPTUNE IVORY suffered damage during heavy weather on the 19th on a passage from Yokohama to Seattle.

WEATHER LOG, MARCH 1986 -- The normal scene on the climatic charts is a large Aleutian Low centered over the middle Aleutians with a secondary center in the Gulf of Alaska. The whole system dominates the ocean north of about 45°N. This month the centers were 14-mb stronger than normal, southeast of their normal spots and the circulation covered the Pacific waters north of 30°N (fig. 49). To the south the ridge of high pressure was about normal. Pressure was slightly higher than normal in the Sea of Okhotsk (fig. 49). These features were reflected at the 700 mb level where a - 149 m anomaly was centered near 45°N, 155°W.

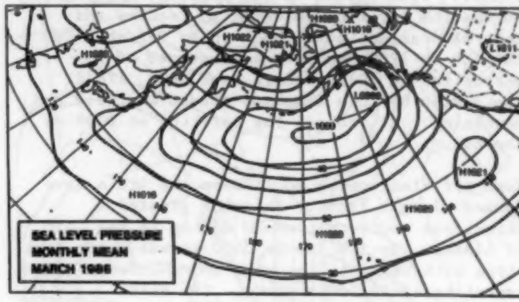


Figure 49.-- March Mean Sea Level Pressure.

Extratropical Weather -- There was a flurry of activity in the Gulf of Alaska during the first 2 weeks. These storms for the most part were short-lived and not intense but they did bring some locally rough conditions to the fishing fleet. As reflected in the pressure and track charts for the month many storms developed in the waters around Japan and made a long east northeastward journey across the Pacific. However very few of these made it to the West Coast of North America. On the 3d, for example, a LOW that had developed near 40°N, 150°W generated winds of 40 kn with gusts to 60 kn as reported by the fishing vessel ICELANDER; she was also accumulating 1 in of ice per hour. Near Paule Bay the BEL AIR reported 40 kn with gusts to 80 kn. Throughout the month there were rough weather reports from these fishing vessels.

In Japan on the 23d a freak snowstorm with typhoon-force winds cut electrical power, triggered a train crash, left at least 13 people dead and some 330 injured. Three people died in accidents caused by the storm, which dumped 3.5 in of snow in the Tokyo area, while two vessels sank in strong seas south of Tokyo Bay (see casualties). The storm toppled five electrical transmission towers in Kanagawa Prefecture, southwest of Tokoyo. An eight-coach express train crashed into another train in Tokoyo.

On This Date -- March 20, 1948 -- Juneau, Alaska received 31 in of snow within 24 hr. This was a record for the capitol.

This LOW actually formed at the end of last month between Kyushu and Shikoku and was generating gales around a tight circulation. However most of the action took place on the first 5 days of this month. At 0000 on the 1st

the SEALAND INNOVATOR near 35°N, 151°E encountered westerlies at 50 kn in 38-ft swells. The storms central pressure dropped from 976 mb at 1200 on the 1st to 960 mb some 24 hr later as it moved close to the Dateline near 43°N. Early on the 3d winds in the 45-to 50-kn range were being reported by the KOREAN LEADER, ORIENTAL TAIO and MOBIL ARCTIC southwest of the storm center. Swells were in the 20-to 25-ft range. During the day the LOW began to recurve and central pressure built back up to 972 mb. On the 4th at 1200 the JQVV encountered 45-kn westerlies in 30-ft swells near 38°N, 176°E. The system by this time was headed westward and weakening. It crossed the Dateline at 0000 on the 6th.

Just off Vladivostok at 1200 on the 4th a wave formed along a front. This LOW started a circuitous route that would end up in the Gulf of Alaska. By the 7th at 0000 it was a big time storm with ships to the west and southwest reporting 45-to 50-kn winds. The HAPPY BUCCANEER was less than that when she ran into 50-kn westerlies in 30-ft seas near 27°N, 160°E. By the 8th central pressure had fallen to 970 mb and the storm was able to maintain this intensity for the next couple of days. Ships in the storm's southwest quadrant were reporting swells in the 15-to 30-ft range. The MOBIL ARCTIC had reported westerlies at 60 kn on the 7th, in 33-ft swells, while the following day the CAVALRY hit 49-kn westerlies near the Dateline and 32°N. The CONTINENTIAL SPIRIT (35°N, 170°W) at 1800 on the 8th radioed 50-kn westerlies in 33-ft seas. On the 9th, after crossing the 145th meridian, the LOW made its turn toward the northeast. The following day it shifted north northwestward. The MING OCEAN, nearly 600 mi south of the center at 1800 on the 9th, reported 53-kn westerlies in 20-ft swells. On the 10th ships were indicating 40-to 45-kn winds were being generated by this storm. On the 11th the AGNES FOSS near 60°N, 152°W estimated winds at 55 kn in 14-ft seas. Off the coasts of Oregon and Washington 20-to 25-ft seas were being reported. The following day the system weakened rapidly and stalled.

This trans - Pacific express formed on the 8th south of the Chingtao Peninsula. Making about 600 mi per day and using the 45th parallel for navigation, this storm arrived in San Francisco on the 16th. While not a powerful storm it did cause some shipping problems on the latter part of its journey, along with another system to its west. At 0000 on the 15th, as the storm was swinging southeastward, the PACBARONESS encountered 55-kn westerlies near 39°N, 141°W in 25-ft swells while the CAIRNSMORE hit 51-kn winds in 20-ft swells near 50°N, 137°W. At 1800 the JFMO reported 53-kn winds in 20-ft swells about 400 mi southwest of the storm's center, which was preparing for a California landing.

On the heels of the previous storm came this LOW, which developed on the 11th just south of Tokyo. By the 13th it was fairly well developed (fig. 50). At 0600, near the 976-mb center, the DOLINSK reported 58-kn winds while battling 26-ft seas; her pressure was 980 mb. A little farther south the PETR VELIKY had westerlies at 45 kn in 23-ft seas. Six hours later the DOLINSK was still encountering 58-kn winds. Several vessels in the southwest quadrant were encountering 40-kn winds in 15-to 20-ft seas as the storm turned toward the east northeast. Central pressure was about 974 mb through the 14th but then started to rise the following day. At 0600 on the 15th the KASUGAI MARU was belted by 49-kn winds near 54°N, 177°E, well northwest of the center. Three hours later her winds were up to 59 kn. On the 16th the storm weakened over the Aleutians, and was replaced by another system.

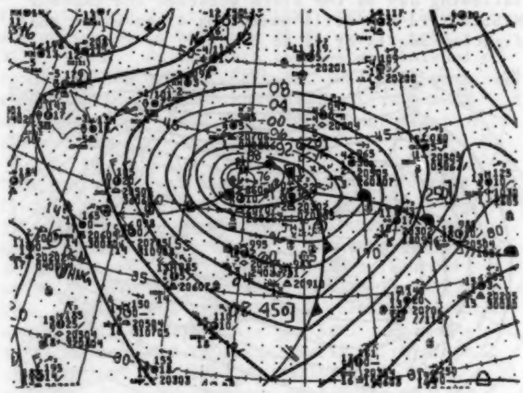


Figure 50.-- The 976-mb storm at 0000 on the 13th.

On the 14th a LOW developed just east of Mongolia. It began its ocean voyage the following day over the sea of Japan and and headed up the Kurils on the 16th and 17th. While the central pressure only dropped to 979 mb (1200 on the 17th) there was no lack of ship reports indicating the intensity of this system. The NOBOBIRIOUSSINSKY (45°N, 149°E) at 0600 on the 16th encountered 58-kn southeasterlies while the VAFFA was measuring 46-kn north northwesterlies in 33-ft seas near 49°N, 168°E. On the 18th the KASUGAI MARU battling 30-ft seas near 52°N, 163°E, at 0300, came in with measured 53-kn east southeasterlies. By this time the storm was moving over the southern portion of the Kamchatka Peninsula. It was laid to rest 2 days later in the north.

This LOW came to life on the 22d northeast of Taiwan. On the 23d and 24th the BUNGA MELANIS reported 50-to 52-kn winds in seas of more than 30 ft as she sailed the 35th parallel just east of Tokyo. The ALPINE ROSE near 37°N, 142°E, at 0000 on the 24th encountered 53-kn winds in 39-ft swells as the 964-mb center paralleled the Kuril Islands. Winds of 45 to 55 kn also were

reported by the PRESIDENT LINCOLN, AMERICAN AQUARIUS and ASIAN VENTURE on the 24th(fig.51); AMERICAN AQUARIUS estimated swells at 46 ft. By the 25th pressure had risen to 972 mb as the center crossed the 45th parallel near 157°E. At 0000 on the 24th more than two dozen ships radioed in with winds ranging from 45 to 60 kn in this circulation. Tops was the PDHG which came in with north northwesterly winds at 60 kn near 37°N, 143°E. The storm remained potent for the next several days as it slowed and turned eastward.

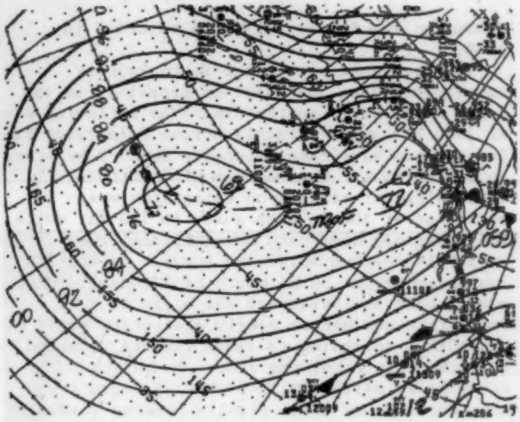


Figure 51.-- Large circulation is apparent at 1200 on the 24th.

Southwest of Kyushu, over the East China Sea, a storm came to life on the 27th. It wasn't much of a LOW at first, just a small, weak wave along a stationary front. It moved east northeastward like many of the storms this month. And when it reached the 150th meridian on the 29th, things, started to come together. One indication came from the ASIAN VENTURE, at 2300 on the 29th, near 38°N, 157°E where she measured 55-kn winds out of the north northeast in 30-ft seas. In general ships were reporting 35-to 45-kn winds in 10-to 20-ft seas. By 1200 on the 30th central pressure was down to a minimum of 978 mb and the HOJIN MARU some 400 mi to the south, encountered 53-kn west southwesterlies. The PIONEER MARU at 0300 on the 31st was cruising near 38°N, 178°E when she ran into 64-kn measured winds in 33-ft swells and 17-ft seas; her visibility was reduced to .25 mi in blowing spray. For the next 6 hr these conditions plagued the vessel although winds gradually slackened to 47 kn and visibility improved to .5 mi. She was about 150 mi south of the storm which was heading east northeastward at a forward speed of 35 kn. By April 1 (fig.52) the 980-mb LOW was heading for the Gulf of Alaska. Winds of 35 to 50 kn were still being reported and seas of 15 to 20 ft were common. Gales continued through the 2d but the system was weakening.

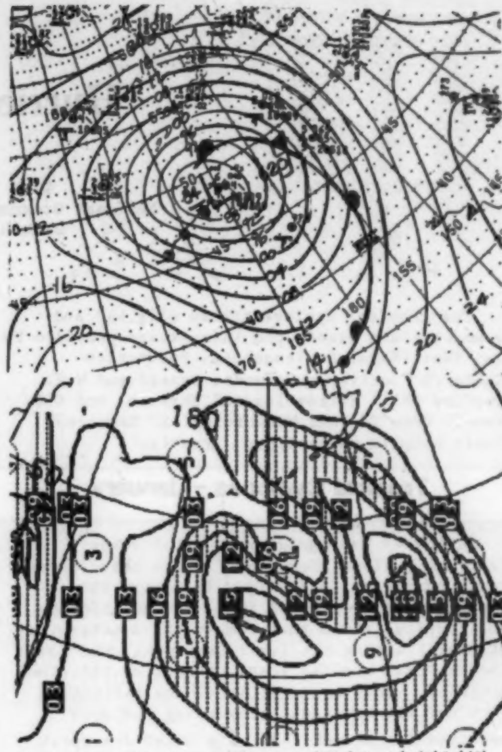


Figure 52.-- The storm and its associated wave height (ft) pattern at 1200 on April 1st.

Casualties -- All 12 crewman of the South Korean vessel CHANGYONG NO. 2 were rescued after their vessel sank in rough seas off of Yochon on the 5th. The MIZUHO MARU NO. 51 ran aground in dense fog at 0800 on the 8th about 150 m from Ninhonoseki Lighthouse (Shimane Prefecture). The following day the tug CRAIG FOSS nearly sank in 70-kn winds and 20-ft seas off Coos Bay, when her engineroom flooded. On the 14th the sand carrier MEIWA MARU NO.2 capsized due to heavy weather off Kanda. The master was reportedly found dead and two other crewman were missing. On about the 31st the MICRONESIAN INDEPENDENCE, Los Angeles for Honolulu encountered heavy weather and rough seas, causing damage to the bow-thruster and three containers. Between Yokohama and Singapore, from the 22d to 24th, the LANKA AJITHA suffered heavy weather damage as did the AIKINDI between Singapore and Kobe. Japanese patrol vessels rescued 19 crewman and assisted the SHI ZUI SHAN to safety when she began shipping water during a snowstorm off Japan on the 23d; one crewman was missing. A Japanese Coast Guard helicopter plucked from icy waters south of Tokyo the sole survior of an 8-man crew from the SHOEI MARU which sank during this same storm. In another incident the YOSHIDA MARU NO. 16 sank in nearby waters, but all three crewman were rescued.

Hurricane Alley

Dick DeAngelis
National Oceanographic Data Center
Washington, D.C.

The tropical cyclone tracks (fig.53) and summaries are based upon information provided by Ted Tsui (Naval Environmental Prediction Research Facility), Rajendra Prasad and M.R. Laidlaw (Fiji Meteorological Service) and C.G. Revell (New Zealand Meteorological Service). Their help is appreciated, greatly.

Tropical Cyclones - January

During an average January about seven tropical cyclones develop of which about three reach hurricane intensity. This year the figures were eleven and four. In addition to the tropical storm that roamed the southern Bay of Bengal during the first two weeks, the South Indian Ocean was the scene of most of the other activity. This included hurricane Delifinina with her 110-kn winds, traversing the 80th meridian for a week. After a brief dry spell activity picked up again, this time the seas northeast and northwest of Australia provided the setting except for a viscious late month hurricane — Erinesta which was at its worst in early February. Her maximum winds were estimated at 115 kn as she passed between Madagascar and the Mascarene Is. Of the four Australian storms during the second half of the month, hurricane Winifred was the worst. Sporting winds of 70 kn, he moved into north Queensland before dawn on the 2d. Although the port of Cairns was closed to most shipping for several days most of the ports escaped major damage. At least two people were reported killed and crop damage was estimated at more than $70 million. In some areas the cyclone dumped up to 16 in and flooding was extensive.

Tropical Cyclones - February

Led by typhoon Judy, which was spotted on the first day, nine tropical cyclones came to life throughout this month; Ima and Judy were the only ones of hurricane intensity. The average is about six tropical cyclones of which three became hurricanes. In post analysis Judy may end up as a January typhoon, however most of her life was spent in the first week of February. During the past 28 yr there have been six January typhoons and just one typhoon during February; the February typhoon occurred in 1970.

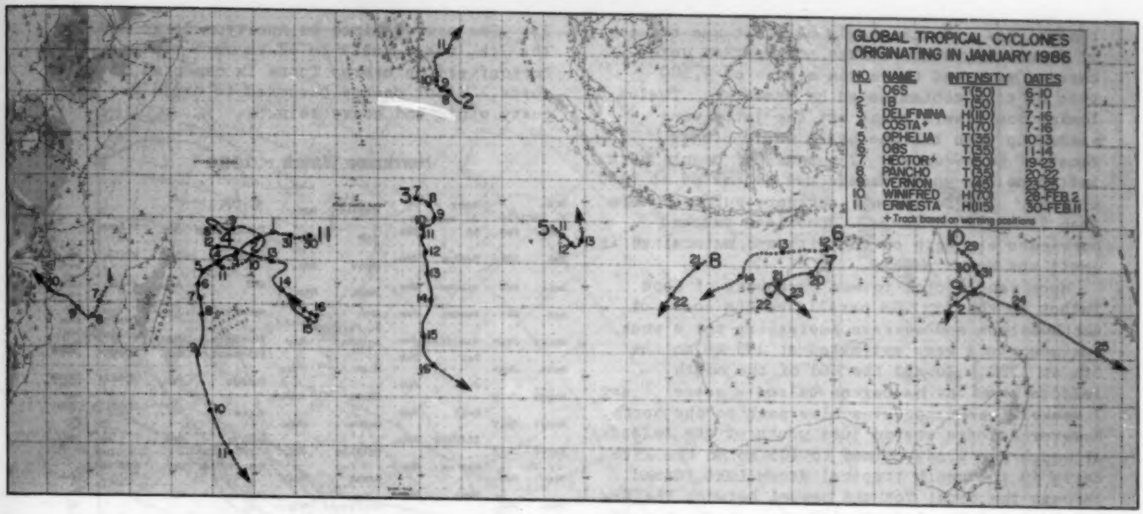
Ima developed within the South Pacific Convergence Zone just east of Keppel Is in the Tonga Group early on the 5th. The following day at 1500 she moved directly across Palmerston Is. Ima reached hurricane intensity about 3 hr prior to her arrival. The maximum wind at the meteorological station on Palmerston was estimated at 100 kn with gusts to 150 kn; while the winds may have been overestimated they certainly reached hurricane force. On the 7th Ima passed about 30 mi north of Aitutaki. While moving east southeastward she began to decelerate and became nearly stationary early on the 10th. According to radar reports received from the ship BALNY the storm was moving erratically until the 11th when it began a counterclockwise loop, finally heading southward on the 13th. The following day Ima dropped back to tropical storm strength. Palmerston and Aitutaki were declared disaster areas but fortunately there was no loss of life. Maximum winds on Aitutaki reached 42 kn on the 7th at 0500 with 72-kn gusts at 0730. The lowest pressure was 982.7 mb on Palmerston.

Tropical storm Keli developed in the vicinity of New Caledonia and Vanutau. The cloud cluster from which she developed can be traced back to near 17°S, 161°E at 1800 on the 7th. By 2100 on the 8th she had organinzed into a tropical storm. The system reached peak intensity at about 0300 on the 9th when maximum winds were estimated at 50 kn with gusts to 70 kn. At this time Keli was at sea and no ship reports were available. Earlier, land stations had reported sustained winds in the 25-to 32-kn range. The airport on Tongatapu reported a 54-kn gust about 0900 local time on the 11th.

Tropical Cyclones - March

A normal year sees five tropical cyclones, two which become hurricanes, develop in March. This year was just above average with six and three. The three hurricanes, Victor, Honorinina and Jefotra all generated winds in excess of 100 kn.

Honorinina was the most powerful with winds reaching 140 kn before she moved into Madagascar on the 15th. The damage was devastating and an estimated 32 people lost



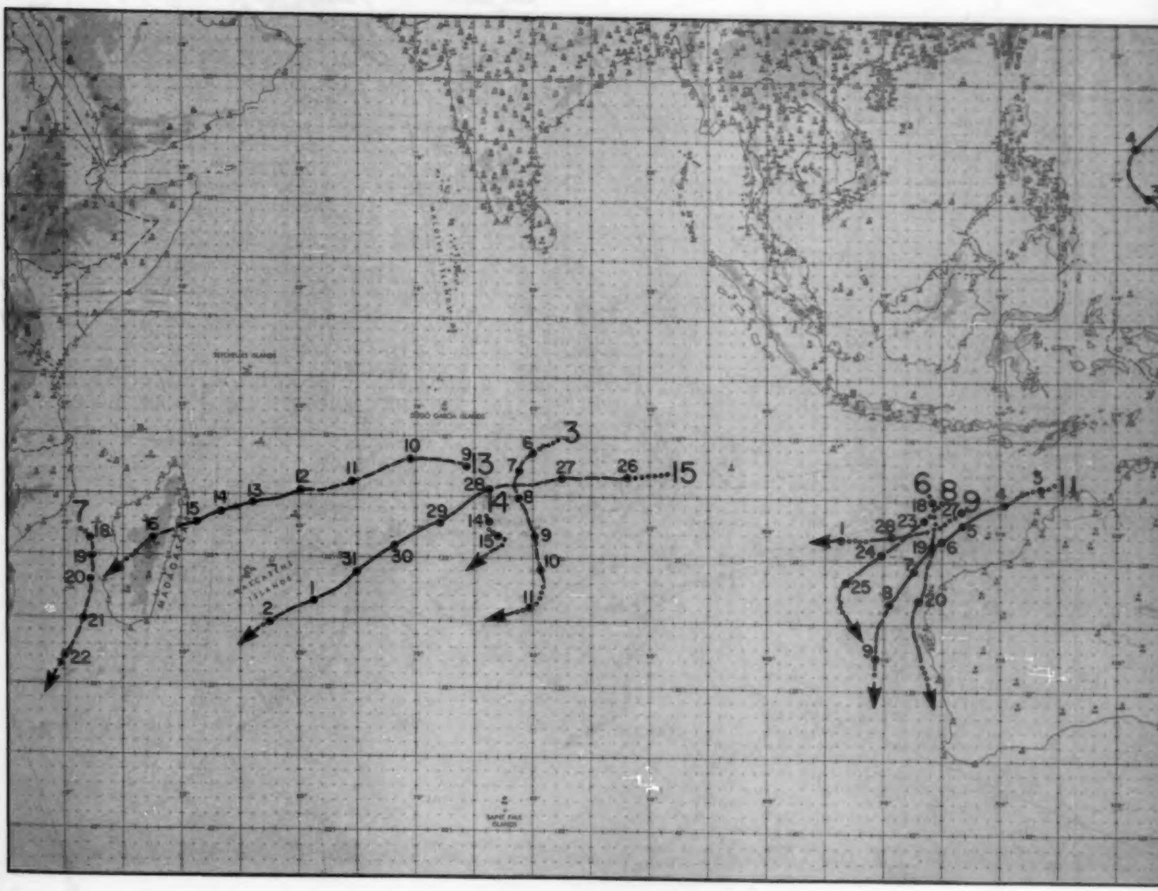


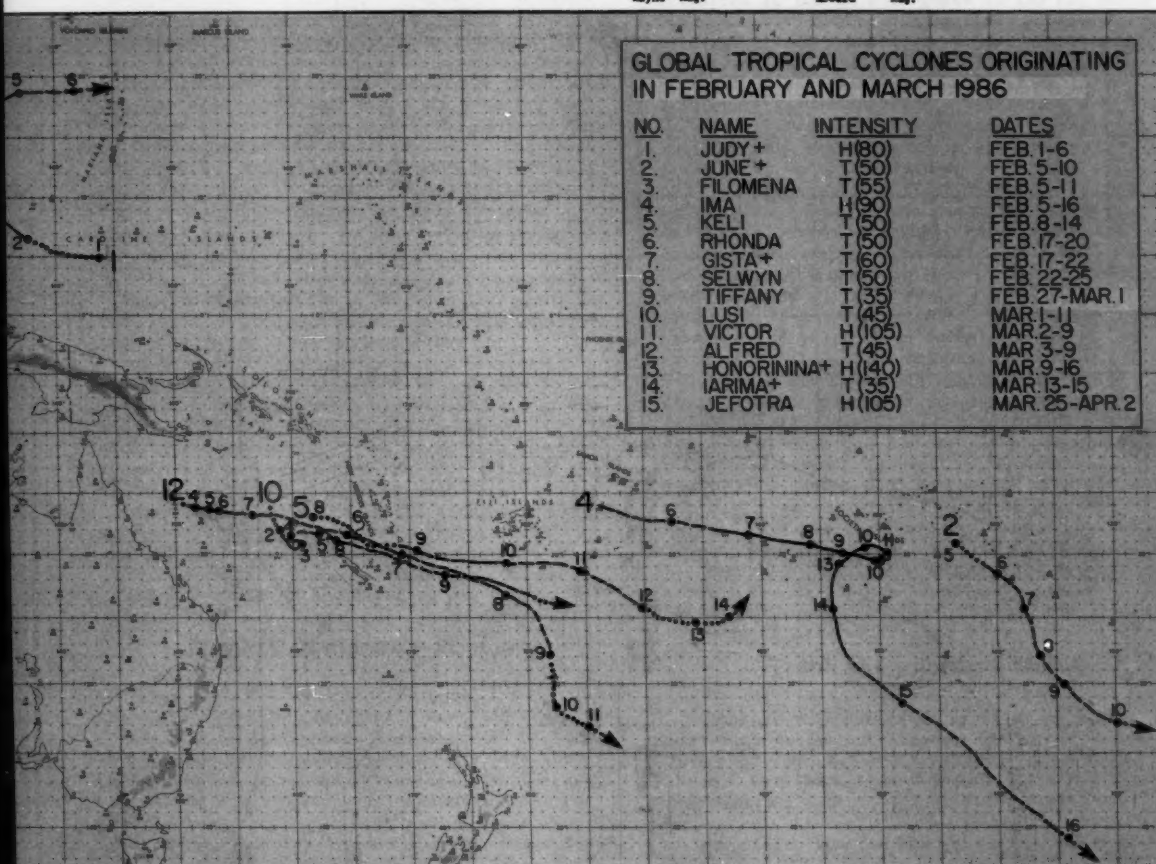
Figure 53.-- Tropical Cyclones for January, February and March 1986.

their lives. Particularly hard hit was the port of Toamasina, where cranes and jetties were carried away and there was a loss of 4,500 tons of rice contaminated by seawater. Twelve loaded containers swept off the jetty were washed up onto the the beach while others remained below water. Thousands of people were left homeless while damage was estimated at $150 million. The Solima oil refinery suffered more than $1 million damage. Honorinia reached hurricane strength on the 11th and maintained it until she moved ashore.

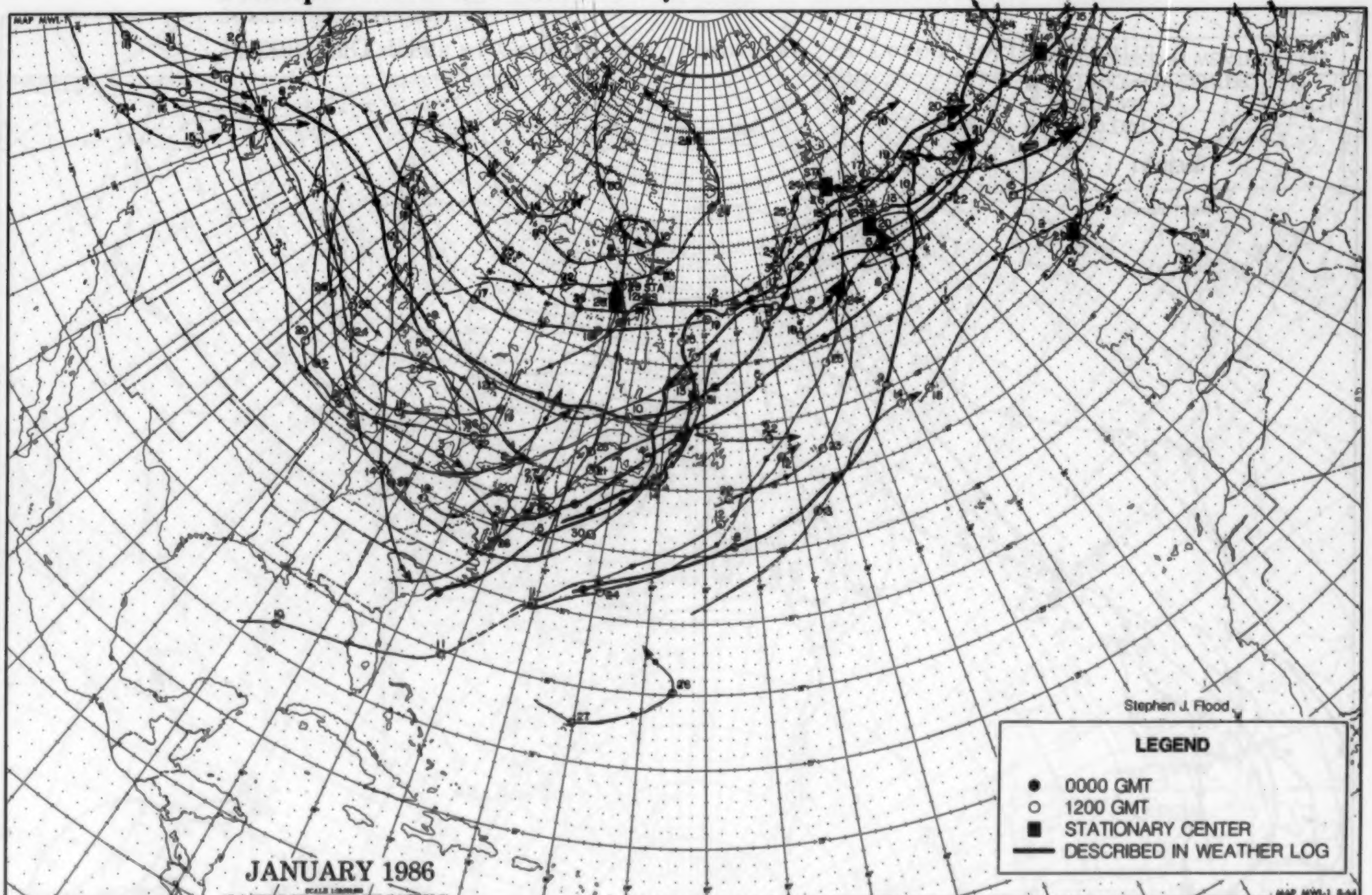
Hurricane Victor formed northwest of Cape Talbot on the 2d. He paralleled the coast of northwestern and western Australian for a week. Maximum winds were estimated at 105 kn on the 5th at 1200. Toward the end of the month Jefotra gave the Mascarene Island a scare , just 2 weeks after Honorinina blew past to the north. However Jefotra stayed just south of the islands although her winds climed to 105 kn on the 29th. Early in the month tropical storm Lusi roamed through the Coral Sea and passed between the New Hebrides and New Calendonia, through the Loyalty Is. She passed close to Aneityum Is at 0000 on the 7th, where gusts to 42 kn were reported. Burtonfield on nearby Tanna Is reported 35 kn gusts. Minor damage occurred to crops due to gusty winds and heavy rain.

Hurricane Watch - 1986

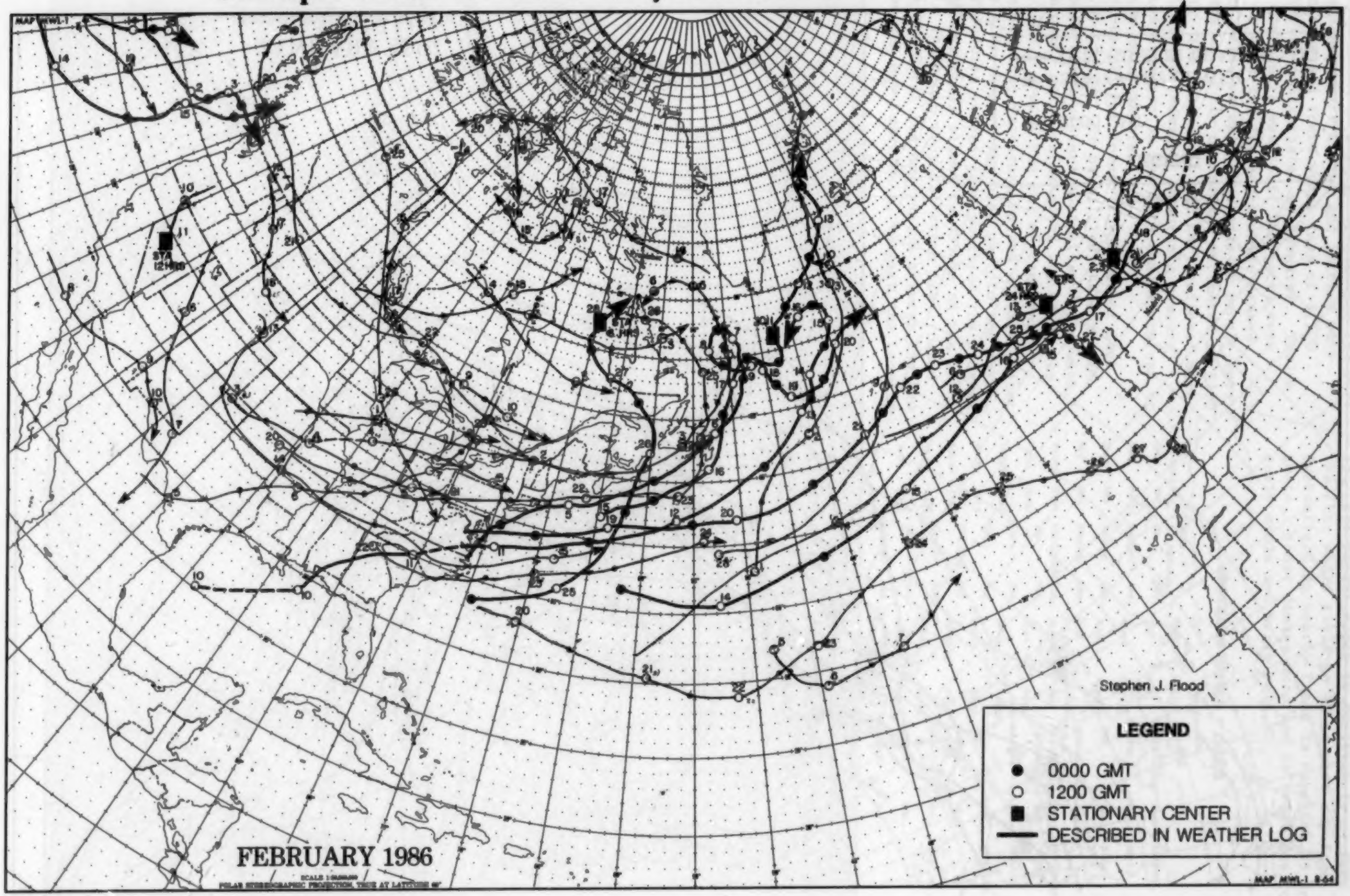
Wrn. N. Pacific		Aust.- S. Pacific		Martin	Apr.	S. Ind.			
Judy	Feb.	8S	Jan.	30P	Apr.	Delifinina	Jan.	Alison	Apr.
Ken	Apr.	Hector	Jan.	Nama	Apr.	Costa	Jan.	Billy	May
Lola	May	Pancho	Jan.	Namu	May	06S	Jan.	34S	Aug.
Mac	May	Vernon	Jan.	Ern. N. Pacific		Ophelia	Jan.	North Atlantic	
Nancy	June	Winifred	Jan.	Agatha	May	Erinesta	Jan.	Andrew	June
Owen	June	Ima	Feb.	Blas	June	Filomena	Feb.	Bonnie	June
Peggy	July	June	Feb.	Celia	June	Rhonda	Feb.	Charlie	Aug.
Roger	July	Keli	Feb.	Darby	June	Gista	Feb.	N. Ind.	
Sarah	July	Tiffany	Feb.	Estelle	July	Selwyn	Feb.	01B	Jan.
Tip	Aug.	Victor	Mar.	Frank	July	Honorinina	Mar.		
Vera	Aug.	Lusi	Mar.	Georgette	Aug.	Iarima	Mar.		
Wayne	Aug.	Alfred	Mar.	Howard	Aug.	Jefotra	Mar.		



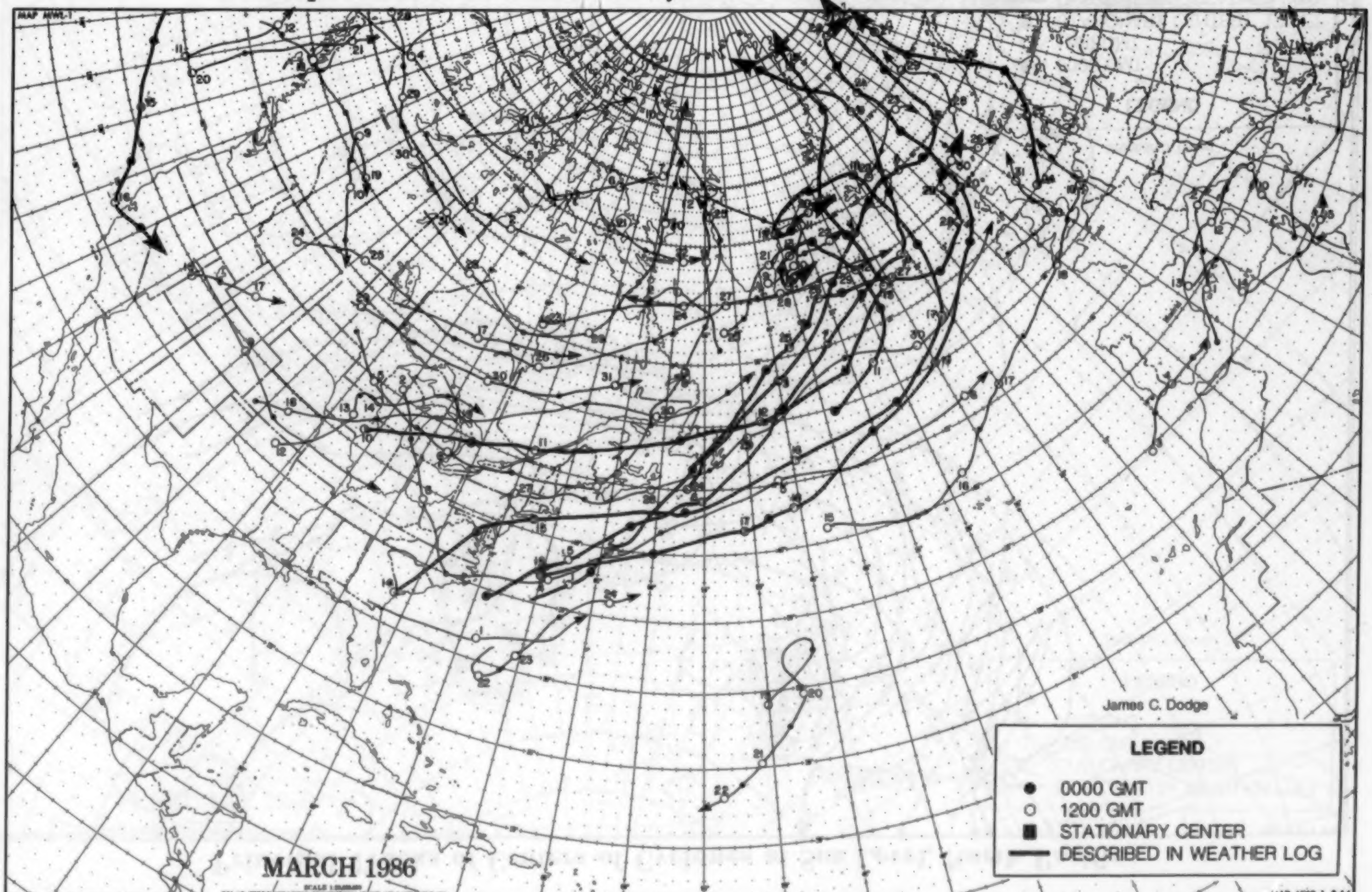
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



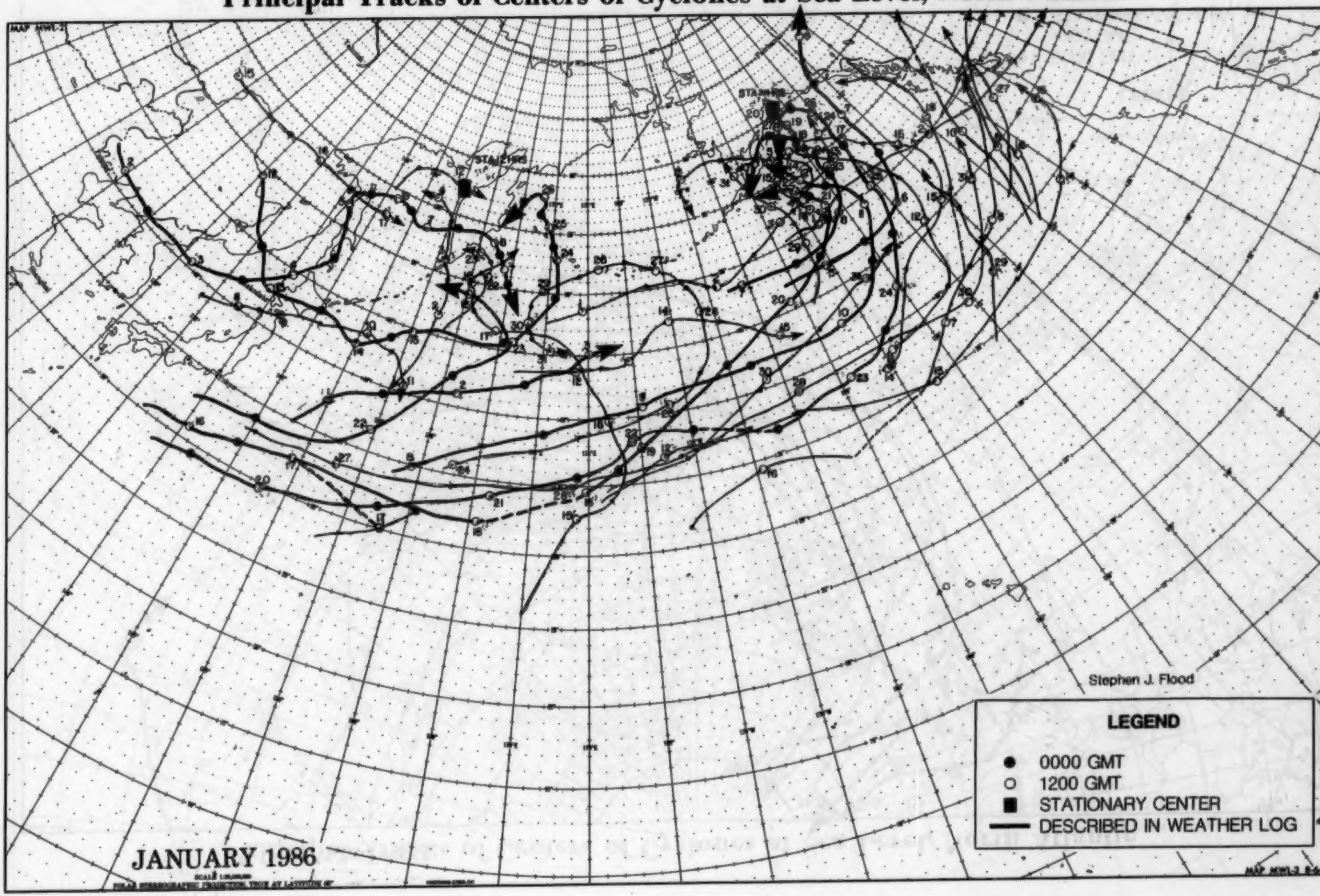
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



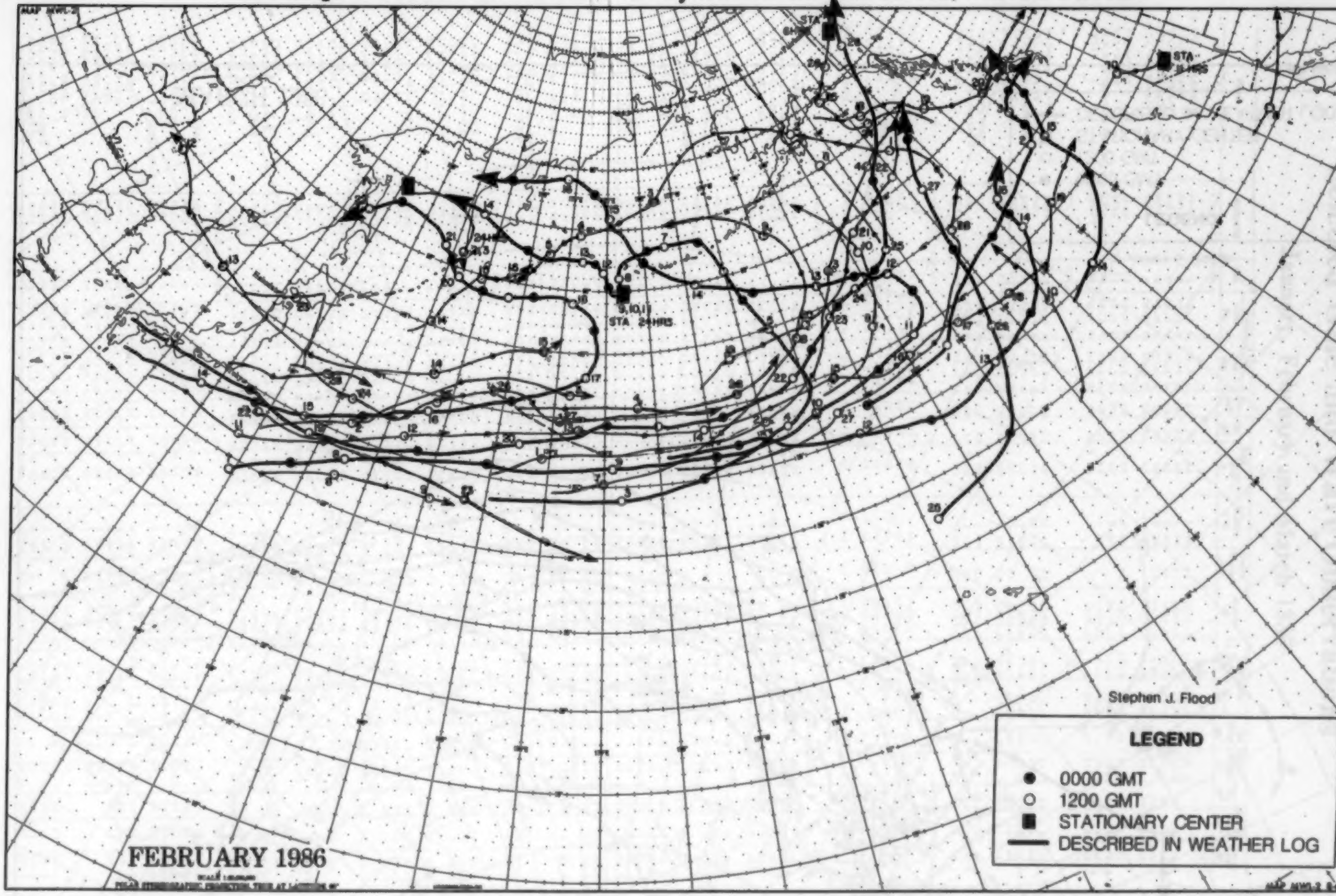
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



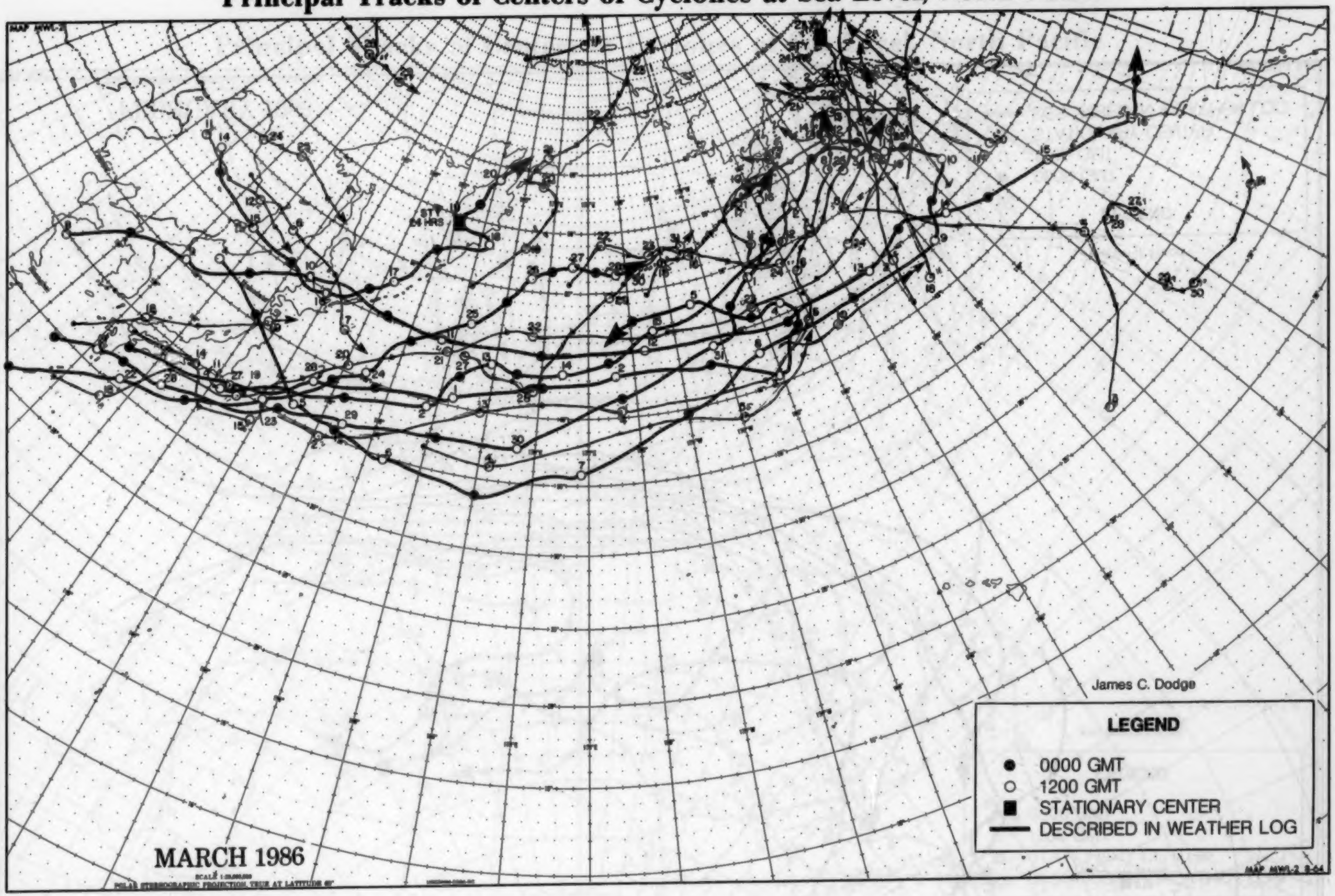
Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Selected Gale and Wave Observations

January, February and March 1986

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves Period sec.	Sea Waves Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
	ATLANTIC	JAN.															
TFL ENTERPRISE	9VVD	1	41.0 N	18.7 W	12	27	M 48	5 NM	07	1015.5	15.0	15.0	14	29.5			
TFL FREEDOM	9VXX	2	43.7 N	17.4 W	06	28	M 45	5 NM	81	1008.5	10.5	15.5	6	11.5	26	15	32.5
TFL DEMOCRACY	9VPR	5	46.4 N	39.5 W	18	26	45	2 NM	26	1006.0	5.0	13.0	14	18	25	21	32.5
TFL DEMOCRACY	9VPR	6	47.9 N	33.0 W	12	29	50	2 NM	26	1002.0	4.0	12.5	12	13	27	30	39
TFL DEMOCRACY	9VPR	6	48.0 N	30.5 W	18	31	45	10 NM		1003.0	10.0	12.0	9	13	27	28	39
AUSTANGER	3FXH	22	46.0 N	12.5 W	12	27	55	2 NM	62	1013.0	12.0	12.0	25	37.5	27	20	31
AUSTANGER	3FXH	23	45.4 N	16.3 W	12	27	50	5 NM		1019.0	13.0	13.0	25	32.5	27	20	29.5
SEALAND PRODUCER	WJBJ	28	48.3 N	18.1 W	18	31	48	5 NM		1009.0	10.0	8.8	6	19.5	31	13	29.5
PACER	FLCF3	30	44.4 N	12.3 W	18	36	M 55			1004.0	8.0	14.0	14	24.5	36	16	29.5
	ATLANTIC	FEB.															
RAINBOW HOPE	KNDB	5	56.3 N	17.6 W	00	16	55	50 YD	65	0996.5	3.9	4.4	5	16.5	15	7	32.5
TFL EXPRESS	9VPU	15	39.5 N	33.9 W	12	28	70	50 YD	07	0980.0	16.0	17.0	15	49	28	14	49
STONEWALL JACKSON	KDDW	15	36.3 N	13.5 W	12	27	65	.5 NM		1005.1	17.2	15.6	10	29.5	27	10	29.5
TFL EXPRESS	9VPU	15	39.4 N	34.1 W	15	31	60	.5 NM	07	1000.2	11.0	17.0	10	41	32	18	44
TFL EXPRESS	9VPU	15	39.3 N	34.5 W	18	30	55	1 NM	16	1010.5	12.0	17.0	9	36	31	17	44
SEALAND ADVENTURER	KSLJ	16	44.8 N	23.3 W	12	32	M 60	2 NM	87	0998.0	6.0		8	8	32	10	32.5
SEALAND ADVENTURER	KSLJ	16	45.4 N	22.5 W	18	32	M 60	1 NM	87	1001.0	9.0		8	39	32	8	39
BARRYDALE	7EOJ	16	42.8 N	46.7 W	18	19	58	1 NM	52	0997.0	15.0	17.0	10	32.5	21	11	10
	ATLANTIC	MAR.															
LONG LINES	WATF	6	39.5 N	45.3 W	12	22	M 58	1 NM	81	0989.5	17.7	18.9	4	16.5	23	6	29.5
ITALICA	IBKL	14	37.5 N	43.9 W	00	32	M 45	1 NM		1025.0	11.0	17.0	8	29.5	32	12	29.5
TRAVE ORE	ELPZ4	26	45.3 N	40.7 W	12	28	55	.5 NM	70	1020.0	4.0	3.0	10	24.5	30	14	29.5
TRAVE ORE	ELPZ4	26	45.4 N	39.7 W	18	29	56	.5 NM	70	1020.5	3.0		12	24.5	30	15	29.5
SEALAND VOYAGER	KHPN	27	45.7 N	37.6 W	00	31	M 48	2 NM	26	1022.9	1.1		8	21	31	9	29.5
RAINBOW HOPE	KNCB	27	53.5 N	27.1 W	00	28	50	1 NM	18	0992.0	- 1.6		6	11.5	29	12	44
	PACIFIC	JAN.															
LOUIS MAERSK	OXMA	1	46.8 N	167.5 W	00	29	M 45	2 NM	07	0996.0	6.1	7.0	XX	29.5			
SEALAND EXPLORER	WGJF	4	47.3 N	160.0 E	06	30	M 49	.5 NM		1019.2	1.0		7	11.5	28	11	29.5
EXXON PHILADELPHIA	WNFJ	7	53.5 N	142.5 W	00	10	M 65	.25 NM	52		5.6	6.1	5	10	10	10	29.5
MOBIL MERIDIAN	KGSM	7	58.5 N	143.2 W	17	13	45	5 NM	58	0964.0	5.0	5.6	10	16.5	12	9	32.5
ARCO TEXAS	KNFD	7	54.5 N	136.9 W	18	22	M 69	5 NM		0985.5	5.6	6.1	13	44	21	12	44
ARCO SAG RIVER	WLCF	7	58.6 N	144.1 W	18	22	55	2 NM	07	0964.2	4.4	5.6	XX	32.5	09	8	6.5
ATIGUN PASS	KSFJ	8	56.7 N	142.6 W	00	25	48	2 NM		0982.5	5.0	5.6	3	10	24	12	29.5
POTOMAC TRADER	WARZ	8	56.4 N	139.2 W	00	22	60	5 NM	01	0989.0	5.6		2	8	22	8	29.5
ALAMEDA	3EIQ3	15	54.4 N	165.5 W	00	34	64	10 NM		0994.5	- 0.2		8	32.5			
PRESIDENT JEFFERSON	WPGE	15	41.7 N	148.9 E	00	30	50	10 NM	01	0992.1	1.1	1.7	6	10	30	14	39
CHARLES LYKES	KLHR	17	32.2 N	163.2 W	00	26	48	.5 NM	51	0985.0	16.7	15.0	3	8	25	XX	32.5
HO-SHO	OVSI	17	48.1 N	170.0 E	06	12	M 45	.25 NM	44	0983.0	3.0	2.0	12	13	12	20	32.5
	KRPB	19	30.8 N	173.8 W	18	27	M 45	10 NM	01	1003.0	17.8	17.8	10	24.5	25	15	29.5
MARGARET LYKES	KRJL	23	52.2 N	153.1 W	12	31	45	5 NM	02	0986.0	1.1	4.0	4	18	31	8	29.5
MARGARET LYKES	KRJL	23	52.4 N	153.8 W	18	31	46	5 NM		0992.0	1.7	4.0	4	16.5	31	8	29.5
CORNUCOPIA	KPJC	23	50.2 N	177.4 E	23	17	47	5 NM	15	0983.0	2.7	3.3	8	19.5	17	12	29.5
MARGARET LYKES	KRJL	24	52.5 N	154.5 W	00	32	45	5 NM	02	0996.0	1.1	4.0	4	14.5	31	9	29.5
NOSAC EXPRESS	LNEJ	24	36.7 N	140.7 W	18	18	M 47			1001.0	17.0	15.-	14	31			
ARCTIC TOKYO	5LJT	25	50.6 N	164.7 E	03	28	M 50	.5 NM	86	0975.0	- 3.0	2.0	6	29.5	28	6	29.5
ALEUTIAN DEVELOPER	WIPL	27	52.5 N	174.5 W	12	09	M 50	5 NM	25	0968.5	3.9	3.9	12	29.5			
PRESIDENT F.D. ROOSEVELT	KRJF	30	39.4 N	163.4 W	18	30	M 68	5 NM		0981.0	7.2	11.7	12	39			
SEALAND EXPLORER	WGJF	30	37.5 N	144.3 W	22	30	M 68	1 NM	07	0985.6	12.5	12.0	8	13	28	12	32.5
MANULANI	KNIJ	31	36.2 N	140.0 W	00	27	55	2 NM	07	0981.0	13.3	13.3	6	18	25	8	32.5
	PACIFIC	FEB.															
CHARLOTTE LYKES	WPH2	1	34.2 N	164.9 W	00	29	45	5 NM	15	1001.5	11.7		7	8	28	12	36
SANKO CAMPANULA	3FVU7	1	42.8 N	141.1 W	04	25	M 67	5 NM	05	0981.7	10.0	11.0	8	32.5	24	10	34.5
KASINA	3FJD2	5	45.8 N	164.3 W	06	09	M 60	200 YD	35		4.0	7.0	6	26	09	9	32.5
LEKA IAFRSM	GXF3	5	46.4 N	163.0 W	06	08	48	.25 NM		0965.0	8.0	4.0	10	29.5			
KASINA	3FJD2	6	45.6 N	161.4 W	03	20	M 45	.25 NM	35	0962.5	6.0	8.0	6	24.5	09	9	32.5
MOBIL MERIDIAN	KGSM	8	60.0 N	146.1 W	00	12	65	1 NM	60	1000.0	5.0	4.4	3	11.5	12	10	32.5
HYUNDAI #7	D7YO	8	34.1 N	175.6 E	06	27	M 55	200 YD	82	1004.0	8.0	12.0	10	32.5	27	10	32.5
HYUNDAI #7	D7YO	10	35.7 N	175.1 W	00	25	M 49	1 NM	07	0977.5	15.1		10	26	25	12	32.5
MING OCEAN	BLHY	10	33.9 N	174.0 W	06	31	M 46			0996.5	14.0	16.0	11	29.5			
HYUNDAI #7	D7YO	10	35.7 N	173.9 W	06	31	M 54	.5 NM	07	0989.5	8.9	15.0	12	41	32	12	42.5
ALAMEDA	3EIQ3	11	46.7 N	148.8 W	12	09	M 47	2 NM	81	0991.2	7.5		8	32.5			
BOGASARI EMPAT	YCSG	11	34.6 N	151.3 W	12	27	P 52	1 NM	95	0984.0	13.0	14.0	21	32.5	27	14	18
ALAMEDA	3EIQ3	12	47.3 N	143.0 W	12	09	M 52	2 NM	63	0993.8	7.5		8	32.5			
OVERSEAS JUNEAU	WWKD	15	36.4 N	123.5 W	18	18	M 45	2 NM		1000.0	12.8	11.1	5	13	21	8	32.5
TRITON	S6FA	16	32.2 N	145.9 E	02	29	P 65	2 NM	53	0996.5	8.0		12	36			
TRITON	S6FA	16	32.7 N	146.0 E	06	31	M 65	2 NM	53	0998.5	9.0	17.0			32	12	44
MARGARET LYKES	KRJL	17	34.8 N	167.5 E	06	28	50	2 NM	62	0994.0	10.0	14.0	4	19.5	28	8	32.5
SEALAND MARINER	KBJF	18	52.5 N	169.7 E	00	11	M 50	5 NM		0980.0	3.5	5.0	13	29.5			
PETERSBURG	WJDC	22	50.2 N	134.5 W	00	10	45	2 NM	61	0995.6	3.9	6.1	6	16.5	12	10	29.5
CHARLES LYKES	KLHR	27	44.4 N	141.5 W	06	22	45	2 NM	64	0970.0	11.7	8.9	8	6.5	19	12	34.5
	PACIFIC	MAR.															
SEALAND INNOVATOR	WGKF	1	35.0 N	151.0 E	00	27	54	10 NM	02	0996.2	10.0		5	5	27	10	37.5
MOBIL ARCTIC	KSPY	3	30.0 N	176.6 W	06	28	53	5 NM	15	1002.0	17.2	17.2	8	23	28	18	32.5
OCEAN COMMANDER #1	3EXA3	5	54.3 N	170.0 W	06	08	M 45	1 NM	04	1000.0	1.0		9	14.5	07	13	29.5
MOBIL ARCTIC	KSPY	5	29.9 N	175.7 E	06	30	50	5 NM	02	0998.7	15.6	15.6	8	26	31	17	29.5
PRESIDENT F. ROOSEVELT	KRJS	5	34.7 N	177.5 W	18	27	M 56	5 NM		0987.5	9.4	13.3	27	39	29	15	29.5
MOBIL ARCTIC	KSPY	7	30.0 N	167.5 E	06	27	60	5 NM	16	0992.0	17.8	16.7	10	29.5	27	18	32.5
LARS MAERSK	OXPD	15	35.0 N	149.6 E	12	13	M 45	5 NM	60	1017.2	13.6		15	29.5	35	15	37.5
TYSON LYKES	WSCJ	19	53.5 N	175.3 E	00	12	45	1 NM	88	1004.2	1.1	0.6	9	32.5	21	9	29.5
BUNGA MELAWIS	9MUT	21	36.9 N	153.1 E	06	26	50	5 NM	60	0998.5	11.5	16.0	10	32.5			
BUNGA MELAWIS	9MUT	23	35.4 N	144.1 E	06	10	50	.5 NM	63	0989.5	13.0	20.0	8	32.5			
BUNGA MELAWIS	9MUT	24	35.0 N	141.7 E	00	36	52	5 NM	03	1000.5	8.0	19.0	8	31			
ALPINE ROSE	H9VS	24	36.6 N	141.8 E	00	34	53			1000.0	3.0	12.0	16	32.5	32	25	39
PRESIDENT LINCOLN	KDBG	24	34.6 N	149.1 E	00	24	50	5 NM		0990.0	15.0	16.7	7	13	23	9	29.5
AMERICAN AQUARIUS	WYBI	24	33.5 N	151.8 E	06	23	45	5 NM	07	0997.9	16.7	15.6	8	10	25	12	29.5
ASIAN VENTURE	3EIO3	29	37.9 N	157.1 E	23	03	M 55	.5 NM	65	0998.5	0.6	1.3	10	29.5	05	12	29.5

U.S. Voluntary Observing Ship Weather Reports

January, February and March 1986

SHIP NAME	VIA RADIO	VIA MAIL
1ST LT ALEX BONNYMAN	17	
2ND LT.JOHN P. BOBO	20	27
ACADIA	22	64
ACADIA FOREST	51	117
ACE ACCORD	1	39
ACE ENTERPRISE	1	
ACT 111	157	
ACT 5	113	
ACT 7	162	
ACT I	7	
ACT IV	80	
ADABELLE LYKES	100	228
ADDIRIYAH	51	
ADM. WM. F. CALLAGHAN	22	423
ADMIRALTY BAY	71	143
AFRIC STAR	43	
AGNES FOSS		58
AL AHMADIAH	8	97
ALAMEDA	70	204
ALASKA MARU	54	
ALASKA RAINBOW	63	10
ALBULA	14	208
ALDEN W.CLAUSEN	23	77
ALEMANIA EXPRESS	67	
ALEUTIAN DEVELOPER	15	57
ALMERIA LYKES	22	157
ALMUDENA		357
ALPINE ROSE	13	38
ALVA MAERSK	21	31
AMADEUS	21	
AMBASSADOR	25	80
AMELIA TOPIC	16	68
AMERICA EXPRESS	57	
AMERICA SUN	47	139
AMERICAN ALABAMA	17	32
AMERICAN AQUARIUS	19	122
AMERICAN ASTRONAUT	31	165
AMERICAN CALIFORNIA	38	87
AMERICAN CONDOR	51	456
AMERICAN CORMORANT		7
AMERICAN EAGLE	56	140
AMERICAN ENVOY	56	141
AMERICAN GEORGIA	9	72
AMERICAN HAWAII		80
AMERICAN ILLINOIS	20	64
AMERICAN KENTUCKY	32	55
AMERICAN LANCER	38	148
AMERICAN LARK	34	157
AMERICAN LIBERTY	45	88
AMERICAN LYNX	43	133
AMERICAN MAINE	12	31
AMERICAN MARKETER	54	154
AMERICAN MERCHANT	67	135
AMERICAN MICHIGAN	6	148
AMERICAN NEBRASKA	42	54
AMERICAN NEW YORK	19	75
AMERICAN OHIO	11	66
AMERICAN OKLAHOMA	41	54
AMERICAN PIONEER	35	138
AMERICAN PURITAN	74	466
AMERICAN RESOLUTE	20	141
AMERICAN SKY	49	65
AMERICAN TITAN AK 1008	70	122
AMERICAN TRADER	28	85
AMERICAN TROJAN	16	
AMERICAN VETERAN		54
AMERICAN VIRGINIA	8	65
AMERICAN WASHINGTON	17	67
AMERICANA	20	68
AMOCO BALTIMORE	7	19
AMOCO CAIRO	13	
AMOCO YORKTOWN	18	19
ANDERS MAERSK	3	23
ANDERSON		170
ANNIE JOHNSON	4	
AQUA CITY	87	143
AQUA GARDEN	28	214
AQUARIUS	76	200
ARCHON	23	194

SHIP NAME	VIA RADIO	VIA MAIL
ARCO ALASKA	1	6
ARCO ANCHORAGE	13	18
ARCO CALIFORNIA	35	54
ARCO FAIRBANKS	45	59
ARCO JUNEAU	37	38
ARCO PRUDHOE BAY	23	10
ARCO SAG RIVER	43	58
ARCO SPIRIT	17	18
ARCO TEXAS	44	55
ARCTIC TOKYO	11	218
ARGONAUT	24	81
ARILD MAERSK	24	33
ARMAND HAMMER	28	423
AROSIA	78	121
ARTHUR M. ANDERSON	1	
ASHLEY LYKES	36	80
ASIA INDUSTRY	1	
ASIA MARU	101	
ASIA WINDS	83	
ASIAN EXPRESS		6
ASIAN VENTURE	6	29
ASPEN	74	
ASTORIA	76	102
ASYA	12	
ATIGUN PASS	95	264
ATLANTIC FOREST	7	338
ATLANTIC RAINBOW	3	132
ATLANTIC SAGA	44	
ATLANTIC SONG	32	
AUSTANGER	20	27
AUSTRAL RAINBOW	4	24
AUSTRALIA	91	
AXEL JOHNSON	46	
B.T. ALASKA	59	248
B.T. SAN DIEGO	115	186
BALDER CARRIER	23	159
BALTIMORE TRADER	53	109
BAN FF	8	49
BAR' ZAN	49	79
BARBER PERSEUS	44	
BARBER PRIAM	96	168
BARBER TAIF	13	
BARBER TAMPA	26	45
BARBER TEXAS	22	35
BARBER TOBA	27	
BARBER TONSBERG	16	39
BARRYDALE	23	72
BAY BRIDGE	30	29
BEAUTEOUS	17	
BEISHU MARU	113	43
BELISLAND		236
BERNINA	33	126
BHARATENDU	9	
BIBI	56	
BISLIG BAY	32	151
BLUE COSMO	71	111
BOGASARI EMPAT	49	181
BOGASARI LIMA	27	73
BOHEME	37	174
BORINQUEN	56	218
BRIGHT SUN	77	74
BRINTON LYKES	26	141
BROOKS RANGE	48	70
BUNGA CHEMPAKA	2	12
BUNGA KESIDANG		34
BUNGA MELAWIS	36	252
BUNGA SRIPAGI	47	122
CALANUS		30
CALIFORNIA RAINBOW	44	21
CANADIAN HIGHWAY	39	
CAP ANAMUR	41	3
CAPE BON	23	59
CAPE DUCATO	15	22
CARLA A. HILLS	23	115
CARMEN	103	106
CAVALIER		68
CAVARA	16	33
CECILIE MAERSK	11	37
CENPAC 2	34	48

SHIP NAME	VIA RADIO	VIA MAIL
CGM LORRAINE	30	
CHABLIS	1	
CHARLES LYKES	72	150
CHARLES PIGOTT		95
CHARLOTTE LYKES	101	219
CHARLOTTE MAERSK	58	171
CHASTINE MAERSK	46	135
CHELSEA	29	443
CHEMICAL PIONEER	36	96
CHESAPEAKE	43	128
CHESAPEAKE TRADER	21	117
CHESNUT HILL	30	237
CHEVRON ARIZONA	15	41
CHEVRON BURNABY	41	221
CHEVRON CALIFORNIA	125	146
CHEVRON COLORADO	14	
CHEVRON COPENHAGEN	76	224
CHEVRON EDINBURGH	17	26
CHEVRON FELUY	11	106
CHEVRON LONDON		65
CHEVRON LOUISIANA	23	77
CHEVRON MISSISSIPPI	94	142
CHEVRON OREGON	47	81
CHEVRON PACIFIC	23	150
CHEVRON WASHINGTON	22	45
CHIKUMAGAWA MARU	15	38
CHRISTIAN MAERSK	10	23
CHRISTINA	29	
CHUEN ON	8	
CITADEL HILL	10	366
CITY OF MIDLAND	4	135
CLARA MAERSK	63	173
CLIFFORD MAERSK	11	62
CLOVER TRUST	22	58
COLIMA	9	
COLORADO HIGHWAY	14	7
COLUMBIA STAR	51	
COLUMBUS AMERICA	8	
COLUMBUS CALIFORNIA	11	
COLUMBUS LOUISANA	112	
COLUMBUS NEW ZEALAND	26	
COLUMBUS VICTORIA	97	
COLUMBUS VIRGINIA	133	
COLUMBUS WELLINGTON	129	
COMMANCHE	1	
CONDORA	1	
CONTINENTAL HIGHWAY	62	6
CONTINENTAL TRADER	33	273
COOP EXPRESS II	113	123
COOP EXPRESS V	61	
COOP GRAIN #2	30	
COPIAPO	2	8
CORNELIA MAERSK	47	118
CORNUCOPIA	30	119
CRYSTAL STAR	45	166
D.L. BOWER		186
DACEBANK	76	
DAGLAND	97	184
DAMIAO SE GOIS	7	35
DART AMERICA	65	
DAVID PACKARD	15	
DAWN	73	87
DELAWARE TRADER	100	55
DELTA MAR	16	67
DIANA		35
DILKARA	5	
DOCTOR LYKES	19	162
DOMINA	4	7
DON JUAN	10	
DONA MAGDALENA		106
DRAGOR MAERSK	12	29
DREW FOSS		68
DUBHE	13	62
DUSSELDORF EXPRESS	47	
DYVI KATTEGAT	32	52
DYVI SKAGERAK	5	259
EASTERN BRIDE	42	
EASTERN FRIENDSHIP	42	

SHIP NAME	VIA RADIO	VIA MAIL
EASTERN GLORY	32	153
EASTERN GRACE		80
EASTERN MAID	81	
EASTERN MOON	3	
EASTERN ROYAL	63	135
EASTERN VENTURE	36	52
EDGAR M. QUEENY	11	418
ENDEAVOR	9	74
ERLANGEN EXPRESS	21	
ESSO BAHAMAS	1	
ESSO PALM BEACH		145
ESTHER SCHULTE	14	129
EVER GATHER		8
EVER GENTLE	5	
EVER GIFTED	11	30
EVER GLEAMY	21	19
EVER GLOBE		54
EVER GLORY	4	44
EVER GOLDEN	9	
EVER GOVERN	8	15
EVER GRACE	35	52
EVER GRADE		28
EVER GRAND	3	
EVER GROWTH	35	77
EVER GUARD	15	14
EVER LAUREL	28	57
EVER LEVEL	6	
EVER LINKING	17	9
EVER LIVING		8
EVER LOADING	6	33
EVER LYRIC	15	5
EVER SHINE	14	38
EVER SPRING	9	28
EVER SUMMIT	44	121
EVER SUPERB	43	57
EVER VALOR	42	133
EVER VALUE	23	29
EVER VIGOR	10	50
EVER VITAL	86	22
EXPORT CHALLENGER	13	71
EXPORT CHAMPION	32	81
EXPORT FREEDOM	32	88
EXPORT PATRIOT	26	110
EXXON BALTIMORE	6	86
EXXON BATON ROUGE	22	67
EXXON BAYTOWN	1	14
EXXON BENICIA	14	3
EXXON BOSTON	56	122
EXXON GETTYSBURG	1	89
EXXON HOUSTON	28	130
EXXON JAMESTOWN	30	50
EXXON LEXINGTON	27	39
EXXON NEW ORLEANS	18	29
EXXON NORTH SLOPE	5	39
EXXON PHILADELPHIA	51	70
EXXON PRINCETON	26	50
EXXON SAN FRANCISCO	21	52
EXXON WASHINGTON	17	32
EXXON YORKTOWN	1	6
FALCON TRADER	3	7
FALSTRIA	35	98
FEDERAL FRASER	8	
FEDERAL LAKES	57	45
FERNCROF	40	133
FETISH	9	183
FIVE STAR	8	37
FLORIDA RAINBOW	22	173
FORTALEZA	100	214
FRANCIS SINCERE NO. 6	24	25
FRANKFURT		
FREDERICKSBURG	15	113
FROTASIRIUS	11	35
GALAXY STAR		83
GALLEON AQUAMARINE	8	36
GALLEON TOURMALINE	6	19
GALVESTON	46	68
GAS LIBRA	1	
GEMINI	83	178
GENERAL M.BELGRANDO	6	
GENEVIEVE LYKES		33
GENISTA	1	137
GERONIMO		12
GLACIER BAY	55	38
GLOBAL FRONTIER	79	65
GLOBAL SPLENDOR	65	165
GLORIOUS SPICA	34	44
GOLD BOND CONVEYOR	1	
GOLDEN APO	2	
GOLDEN BEAR	45	
GOLDEN BLISS	31	
GOLDEN ENDEAVOR	86	31
GOLDEN GATE		4
GOLDEN GATE BRIDGE	99	85
GOLDEN GRAMPUS	3	
GOLDEN HAWK	35	119
GREAT LAND	31	18
GREAT OCEAN	45	108
GREEN AUKLET	7	
GREEN FOREST	35	29
GREEN ISLAND	47	37
GREEN MASTER	84	196
GREEN MAYA	31	59
GREEN SASEBO	26	24
GREEN STAR	49	
GREEN VALLEY	54	45
GREEN WAVE	36	55
GUNDULIC	1	
GUS W.DARNELL	55	118
GYPSUM COUNTESS	62	
GYPSUM KING	129	
H. LEE SELVY	3	
HAKUSAN MARU	119	
HANJIN BUSAN	5	
HANJIN INCHEON	2	16
HANJIN KWANGYANS	8	34
HANJIN POHANG	25	10
HANJIN SEOUL	1	27
HASSAN MERCHANT	18	21
HEERENGRASHT	80	
HEILBRONN	1	
HERMINIA	5	28
HIEI MARU	114	
HIKAWA MARU	150	
HIRA MARU	122	
HO-SHO	52	38
HOEGH CAIRN	11	
HOEGH CLIPPER	3	32
HOEGH DUKE	62	
HOEGH MARLIN	39	128
HOEGH MASCOT	9	236
HOEGH MINERVA	19	84
HOEGH MIRANDA	39	110
HOHSING ARROW	20	98
HOHSING BREEZE	60	166
HOLIDAY	24	130
HONOLULU	80	
HOTAKA MARU	142	54
HOYO MARU	26	7
HYUGA MARU	67	
HYUNDAI # 14	5	
HYUNDAI #101	9	56
HYUNDAI #7	37	42
HYUNDAI CON #7	3	10
INCOTRANS PACIFIC	20	
INCOTRANS SPIRIT	75	
INGER	26	18
IRIS ISLAND	23	
IRVING ARCTIC	16	
ISLAND PRINCESS	84	
ITALICA	19	19
IVAN TOPIC	11	
J.T. HIGGINS	1	
JALAGOVIND	21	
JALAMOKAMBI	6	
JALAVIHAR	122	
JALAVIJAYA	1	
JAMES LYKES	1	
JAPAN ALLIANCE	97	
JAPAN AMBROSE	84	
JAPAN APOLLO	71	65
JEAN LYKES	20	39
JOHN A. MCCONE		145
JOSEPH LYKES	1	28
JULIUS HAMMER		116
JUPITER NO. 1	27	
KAMNIK	13	
KASINA	46	92
KASTURBA	15	
KAUAI	59	175
KENAI	17	72
KENNETH E. HILL	2	52
KENNETH T.DERR	25	137
KENT	24	65
KENWOOD	11	31
KEYSTONE CANYON	43	258
KEYSTONER	31	176
KISO MARU	110	
KITTANNING	58	138
KNORR	21	
KOFUKU MARU	27	71
KOLN EXPRESS	65	
KOREAN FIR	5	
KOREAN JACEWON	28	69
KOREAN PRIDE	7	
KOREAN WONIS JIN	30	53
KOREAN WONIS ONE	23	70
KOREAN WONIS SEVEN	25	36
KOREAN WONIS SUN	24	9
KUROBE MARU	116	
LA PAMPA	4	
LAKE SUWA	59	133
LANAI	45	
LARS MAERSK	33	94
LASH ATLANTICO	44	110
LASH ITALIA	13	5
LASH PACIFICO	19	74
LAURA MAERSK	35	29
LAURA S	66	143
LAUST MAERSK	21	95
LEDA MAERSK	19	62
LEISE MAERSK	40	102
LEO TEMPEST	13	
LESLIE LYKES	16	40
LETTTIA LYKES	7	
LEXA MAERSK	28	100
LICA MAERSK	9	32
LILLOOET	54	74
LILLY STAR	14	
LING LEO	62	140
LIONS GATE BRIDGE	189	
LNG TAURUS	46	177
LONG LINES	15	70
LONGEVITY	11	54
LOTUS ACE	86	
LOUIS J. HANGE	10	
LOUIS MAERSK	29	78
LOUISE LYKES	96	120
LOUISIANA MAMA	22	62
LT. ODYSSEY	22	161
LUCENT STAR	140	
LUNA MAERSK	12	12
LURLINE	130	200
LUZON	27	53
LUZON VICTORY	11	
M. P. GRACE	1	
M/V AMER. NORTH CAROLI	22	132
M/V BHAVABHUTI	34	
M/V CURRENT	64	
M/V DOCK EXPRESS TEXAS	1	91
M/V JUDITH PROSPERITY	11	
M/V MAAM	43	121
M/V MICRONESIAN INDEPE	1	206
MAERSK CLEMENTINE	59	
MAERSK WAVE	77	
MAERSK WIND	92	132
MAIN EXPRESS	80	
MANILA PACIFIC	13	
MANUKAI	71	172
MANULANI	44	162
MARATHA PROVIDENCE	14	87
MARATHA SHOGUN	51	168
MARCHIONESS	17	97
MARCONA CONVEYOR		22
MARGARET JOHNSON	7	
MARGARET LYKES	100	240
MARIA TOPIC	15	

SHIP NAME	VIA RADIO	VIA MAIL
MARITIME NOBLE	73	
MARJORIE LYKES	33	71
MARTHA R. INGRAM	107	346
MAUI	92	208
MCKINNEY MAERSK		30
MCKINNLEY MAERSK	15	53
MELBOURNE HIGHWAY	1	34
MELVILLE	81	220
MENINA BARBARA	9	35
MEONIA	92	83
MERAK EIGHTY	26	21
MICRONESIAN COMMERCE		21
MIHO MARU	87	
MING GLORY	15	58
MING MOON		47
MING OCEAN	41	48
MING STAR	1	
MING SUN	33	22
MING UNIVERSE	7	32
MING WINTER	3	
MITLA	18	61
MOANA PACIFIC	119	150
MOBIL ARCTIC	99	252
MOBIL MERIDIAN	51	199
MOKU PAHU	129	116
MONTRACHET	13	53
MORMACSTAR	18	42
MORMACSUN	9	245
MOSMAN STAR	11	26
MOUNT VERNON VICTORY	56	23
NACIONAL SANTOS	9	10
NANCY LYKES	5	
NATIONAL DIGNITY	13	51
NATIONAL HONOR	8	46
NATIONAL PRIDE	2	28
NAVIGATOR		201
NAVIOS ENTERPRISE	9	
NEDLLOYD ELBE	89	
NEDLLOYD KEMBLA	61	
NEDLLOYD KIMBERLEY	101	
NEDLLOYD KINGSTON	108	
NEDLLOYD ROCHESTER	60	
NEDLLOYD ROSARIO	84	
NEDLLOYD ROTTERDAM	82	
NEDLLOYD ROUEN	40	
NEPTUNE AMBER	44	65
NEPTUNE CONCORD	45	
NEPTUNE CORAL	22	
NEPTUNE DIAMOND	149	134
NEPTUNE KIKU	10	
NEPTUNE PEARL	21	
NEPTUNE TOURMALINE	7	3
NEW HORIZON		55
NEW INDEPENDENCE	87	252
NEW JERSEY MARU	111	
NEW YORK MARU	139	
NEWARK	51	121
NICOLA PROSPERITY	5	
NISSAN LAUREL	56	
NISSAN MARU	11	
NISSHU MARU	19	
NOAA DAVID STARR JORDA	42	8
NOAA SHIP ALBATROSS IV	61	117
NOAA SHIP CHAPMAN	116	96
NOAA SHIP DELAWARE II	126	152
NOAA SHIP FERREL	9	10
NOAA SHIP JOHN N COBB	18	95
NOAA SHIP MCARTHUR	26	39
NOAA SHIP MILLER FREEM	96	223
NOAA SHIP OREGON II	63	72
NOAA SHIP RESEARCHER	71	342
NOAA SHIP T. CROMWELL	124	44
NOORDAM	55	
NORDHVAL	112	181
NORDWOGE	52	66
NORWAY	2	
NOSAC EXPRESS	4	81
NOSAC SEL	5	240
NOSAC VERDE	26	44
NOVA EAGLE	59	74
NUESTRA SENORA DEL ROS	8	32
OAK PEARL	66	86
OAK SUN	53	132
OBERON	11	
OCEAN CHEER	31	97
OCEAN COMMANDER #1	6	210
OCEAN DIANA	26	
OCEAN STEELHEAD	21	63
OCEAN VOYAGER		198
OCTA	30	37
OJI GLORIA	81	
OLEANDER	123	459
OLGA TOPIC	33	142
OLIVE ACE	2	
OMI DYNACHEM	7	9
ORANGE BLOSSOM	39	232
ORCHID #2	17	186
OREGON BRIDGE	80	38
OREGON RAINBOW	11	112
ORIENTAL DIPLOMAT	14	
ORIENTAL EDUCATOR	56	106
ORIENTAL EXECUTIVE	24	91
ORIENTAL EXPLORER	24	137
ORIENTAL GOVERNOR	22	
ORIENTAL KNIGHT	23	36
ORIENTAL MINISTER	5	53
ORIENTAL PATRIOT	24	29
ORIENTAL PRINCE	26	
ORIENTAL TAIO	46	
ORION HIWAY	43	
OVERSEAS ALICE	33	98
OVERSEAS ARCTIC	45	57
OVERSEAS BOSTON	70	178
OVERSEAS CHICAGO	1	
OVERSEAS JUNEAU	9	219
OVERSEAS MARILYN	4	
OVERSEAS NATALIE	2	
OVERSEAS NEW YORK	42	58
OVERSEAS OHIO	28	181
OVERSEAS VIVIAN	17	43
OVERSEAS WASHINGTON	35	49
PACBARON	20	
PACBARONESS	8	36
PACDUKE	24	
PACEMPEROR	34	
PACER	1	
PACGLORY	37	22
PACIFIC ANGEL	44	41
PACIFIC ARROW	131	37
PACIFIC EXPRESS	26	24
PACIFIC HIGHWAY	143	
PACIFIC LIGHT	13	33
PACIFIC PRIDE		103
PACIFIC PRINCESS	116	
PACIFIC RAINBOW	46	76
PACIFIC SAGA	20	
PACIFIC SUNSHINE		11
PACIFIC VENTURE	171	
PACIFIC VICTORY	62	50
PACIFIC WING	51	
PACKING	17	12
PACMAJESTY	13	
PACMERCHANT	11	26
PACMONARCH	54	
PACNOBLE	36	50
PALM ACE	65	35
PANAMA	31	49
PARALLA	46	29
PATRIOT	1	
PAUL PIGOTT	7	
PEGGY DOW	129	
PENNSYLANIA RAINBOW	56	66
PENNSYLVANIA TRADER	2	
PERSISTENT TASOS 6		108
PERUVIAN REEFER	27	169
PETERSBURG	29	84
PFC EUGENE A.OBREGON	7	16
PFC. JAMES ANDERSON JR	4	25
PHILADELPHIA	14	59
PHILADELPHIA SUN	72	153
PHILIPPINE VICTORY		70
PHOENIX	15	22
PILAR	7	239
PINE TRUST	22	
PING CHAU		18
PITTSBURGH	7	
PLANTIN	81	84
POLAR ALASKA		171
POLYNESIA	61	55
PONCE	43	106
PORTLAND	23	17
POTOMAC TRADER	45	188
PRESIDENT ADAMS	46	56
PRESIDENT CLEVELAND	16	93
PRESIDENT EISENHOWER	84	205
PRESIDENT F. ROOSEVELT		67
PRESIDENT FILLMORE	1	
PRESIDENT GRANT	76	171
PRESIDENT HOOVER	61	146
PRESIDENT JEFFERSON	56	173
PRESIDENT JOHNSON	31	
PRESIDENT KENNEDY	30	28
PRESIDENT LINCOLN	54	175
PRESIDENT MADISON	62	230
PRESIDENT MC KINLEY	108	210
PRESIDENT MONROE	98	214
PRESIDENT PIERCE	59	141
PRESIDENT TAYLOR	20	56
PRESIDENT TYLER	49	148
PRESIDENT WASHINGTON	160	38
PRESIDENT WILSON	31	17
PRESQUE ISLE		2
PRIDE OF TEXAS	3	197
PRINCE OF TOKYO	77	247
PRINCE WILLIAM SOUND	21	83
PROSPERIDAD	49	
PUNTA ANCLA	18	67
PUNTA MALVINAS	4	
PVT. HARRY FISHER	3	45
QUATSINO SOUND	95	13
QUEEN ELIZABETH II	12	
QUEEN OPAL	77	51
QUEENS WAY BRIDGE	112	
RAINBOW HOPE	1	201
RALPH B. JOHNSON	16	
REGENT CEDAR	20	130
REGINA MAERSK	31	104
RHEIN EXPRESS	22	
RICHARD MATTHIESEN	28	36
RIMBA SEPETIR	19	18
RIO ESQUEL	28	
RIO FRIO	65	
RIO GRANDE	1	
RIO TEUCO	1	
ROACHBANK	64	
ROBERT E. LEE	19	
ROMAN REEFER		13
ROSINA TOPIC	16	136
ROTTERDAM	103	
ROYAL PRINCESS	21	
ROYAL VIKING STAR	2	
S.S. BAYAMON		10
S.S. ROVER	21	118
S.S.CHILBAR	2	
S.T. CRAPO	1	2
SAINT LOUIS	44	321
SAM HOUSTON	24	8
SAMARIA	1	
SAMRAT ASHOK	79	
SAMUEL H. ARMACOST	3	
SAN JUAN	34	111
SAN MATEO VICTORY	8	65
SAN PEDRO	33	77
SANGKULIRANG VII	14	
SANKO AZALEA	14	39
SANKO CAMPANULA	49	37
SANKO CATTLEYA	1	
SANKO CHERRY	20	
SANKO DIAMOND	5	
SANKO DRAKE	10	
SANKO EAGLE	6	
SANKO ELEGANCE	77	
SANKO ETERNITY	13	
SANKO HELENIUM		17
SANKO LAPIS	66	132

SHIP NAME	VIA RADIO	VIA MAIL
SANKO LILAC	35	10
SANKO MARQUESA	7	9
SANKO MOON	1	
SANKO NOBLE	39	
SANKO PEACOCK	6	15
SANKO PEARL	13	
SANKO RELIANCE	112	155
SANKO ROBIN	9	
SANKO STAR	13	
SANKO TOPAZ	5	
SANKO TURQUOISE	3	
SANKO VENUS	6	
SANSINENA II	7	10
SANTA ADELA	78	140
SANTA CRUZ	14	51
SANTA CRUZ II	38	
SANTA ELIZABETTA		31
SANTA JUANA	82	225
SATURN DIAMOND	53	
SAUDI DIRIYAH	33	
SAVONITA	27	2
SAXONIA	1	
SCANDINAVIAN HIGHWAY	54	
SEA BELLS	52	87
SEA DIAMOND	58	86
SEA FAN	83	186
SEA FORTUNE	32	928
SEA JADE	72	73
SEA LANTERN	16	96
SEA LIGHT	20	108
SEA QUEEN	14	
SEA QUEEN NO. 1	19	
SEAKITTIE	1	
SEALAND ADVENTURE	1	
SEALAND ADVENTURER	38	108
SEALAND CONSUMER	47	174
SEALAND DEFENDER	57	152
SEALAND DEVELOPER	73	212
SEALAND ECONOMY	44	170
SEALAND ENDURANCE	52	166
SEALAND EXPLORER	54	144
SEALAND EXPRESS	63	190
SEALAND FREEDOM	49	166
SEALAND INDEPENDENCE	66	168
SEALAND INNOVATOR	61	127
SEALAND LEADER	33	455
SEALAND LIBERATOR	42	167
SEALAND MARINER	65	181
SEALAND PACER	14	461
SEALAND PATRIOT	44	170
SEALAND PIONEER	14	120
SEALAND PRODUCER	58	142
SEALAND VENTURE	72	210
SEALAND VOYAGER	45	529
SELVA	3	
SENATOR	10	
SEVEN OCEAN	22	52
SHELDON LYKES	79	195
SHELLY BAY	3	424
SHIN BEISHU MARU	41	
SHINKASHU MARU	60	
SHIRLEY LYKES	22	
SILVER CLIPPER	1	44
SIOUX TATE	83	153
SKAUGRAN	29	131
SKOUBORD	41	165
SOLON TURMAN	7	
SOUTHERN ACCORD	1	
SOUTHERN CROSS	6	7
SOUTHLAND STAR	134	
SOUTHWARD	6	
SPRING BIRD	31	12
SPRING BREEZE		221
SPRING BRIDE		349
STAR CARRIER		45
STAR DENVER	7	
STAR DIEPPE	97	
STAR DOVER	33	36
STAR HONGKONG	58	143
STAR KANDA	81	75
STAR MINDAWAN	5	
STARWARD	30	75
STELLA LYKES	8	78
STONEWALL JACKSON	16	40
STREAM BUSUANGA	44	

SHIP NAME	VIA RADIO	VIA MAIL
STUTTGART EXPRESS	47	
SUN PRINCESS	43	
SUN VIKING	9	23
SUNBELT DIXIE	199	144
SUNSET PEAK	44	46
TAI CORN	49	32
TAI SHING	14	30
TAMPA	4	6
TENCHBANK	78	
TEXACO CONNECTICUT	13	130
TEXACO FLORIDA	10	
TEXACO GEORGIA	2	48
TEXACO RHODE ISLAND	7	3
TFL DEMOCRACY	10	139
TFL ENTERPRISE	63	459
TFL EXPRESS	18	651
TFL FRANKLIN	85	
TFL FREEDOM	33	456
TFL INDEPENDENCE	10	81
TFL JEFFERSON	5	360
TFL LIBERTY	36	571
THOMAS G. THOMPSON	91	137
THOMAS WASHINGTON	76	119
THOMPSON LYKES	21	
THOMPSON PASS	21	71
TILLIE LYKES	18	178
TOHBEI MARU	64	
TOKYO MARU	59	
TOKYO RAINBOW	64	74
TONCI TOPIC	9	
TONIC VENTURE	2	
TONSONIA	35	279
TOYOTA MARU 10	68	
TOYOTA MARU 11	52	
TOYOTA MARU 15	189	
TOYOTA MARU NO 17	34	
TOYOTA MARU NO 18	72	
TRAVE ORE	68	123
TRIGGER	76	84
TRITON	53	132
TROPIC SUN	2	5
TROPICALE	58	67
TYSON LYKES	84	186
ULTRAMAR	8	55
ULTRASEA	6	
UNAMONTE	21	
UNI-MASTER	43	38
UNI-MODEST	67	
UNICORN		284
UNITED SPIRIT	50	43
UNIVERSE	11	
USCGC ALERT (WMEC 630)	46	
USCGC BISCAYNE BAY	1	1
USCGC BOUTWELL WHEC 71	1	93
USCGC CHASE (WHEC 718)	10	228
USCGC CHEROKEE WMEC 16	18	316
USCGC CLOVER (WMEC 292	13	28
USCGC CONFIDENCE	2	21
USCGC COURAGEOUS	16	
USCGC DALLAS (WHEC 716	13	41
USCGC DEPENDABLE	14	
USCGC DURABLE (WMEC 62		62
USCGC EVERGREEN WMEC 2	1	178
USCGC FIREBUSH WLB 393	35	
USCGC GALLATIN WHEC 72	5	
USCGC GLACIER (WAGB 4)	128	
USCGC INGHAM (WHEC 35)	7	67
USCGC IRONWOOD (WLB 29	7	
USCGC JARVIS (WHEC 725	31	23
USCGC KATMAI BAY	2	4
USCGC LAUREL (WLB 291)		8
USCGC MALLOW (WLB 396)	4	
USCGC MIDGETT (WHEC 72		52
USCGC MORGENTHAU	136	
USCGC MUNRO (WHEC 724)	3	
USCGC POLAR STAR WAGB	201	122
USCGC RESOLUTE WMEC 62	4	
USCGC SALVIA (WLB 400)	30	
USCGC SEDGE (WLB 402)	24	
USCGC SHERMAN (WHEC 72	17	
USCGC SWEETBRIER WLB 4	23	
USCGC TAMAROA (WMEC 16	23	33
USCGC TANEY (WHEC 37)	17	376
USCGC UNIMAK (WTR 379)	85	
USCGC VALIANT (WMEC 62	13	
USCGC VENTUROUS WMEC 6		15

SHIP NAME	VIA RADIO	VIA MAIL
USCGC VIGILANT WMEC 61	21	14
USCGC VIGOROUS WMEC 62	12	79
USCGC WOODRUSH (WLB 40	55	
USCGC YOCONA (WMEC 168	31	
USNS ALGOL	74	
USNS ANTARES	24	
USNS BARTLETT(T-AGOR 1	47	116
USNS CHAUVENET	14	
USNS DE STEIGUER	9	
USNS HARKNESS (T-AGS 3	36	68
USNS MOHAWK (T-ATF 170	11	56
USNS NARRAGANSETT	56	64
USNS NAVAJO	68	90
USNS NEOSHO (T-AO 143)		178
USNS PASSUMPSIC TAO 10		60
USNS PAWCATUCK TAO-108		93
USNS PONCHATOULA	55	118
USNS POWHATAN TATF 166	93	155
USNS REDSTONE	2	
USNS RIGEL (T-AF 58)		240
USNS SEALIFT ANTARCTIC	12	21
USNS SEALIFT ARABIAN S	25	20
USNS SEALIFT ARCTIC	60	
USNS SEALIFT ATLANTIC	17	295
USNS SEALIFT CARIBBEAN	3	
USNS SEALIFT CHINA SEA	35	59
USNS SEALIFT IND'N OCE	27	38
USNS SEALIFT MED	5	6
USNS SEALIFT PACIFIC	58	111
USNS SPICA (T-AFS 9)		48
USNS TRUCKEE (T-AO 147		494
USNS VANGUARD TAG 194	50	347
USNS WACCAMAW(TAO-109)		158
USNS WILKES	10	50
USNS WYMAN (T-AGS 34)	1	
VALLEY FORGE	34	138
VAN ENTERPRISE	69	188
VAN FORT	46	
VAN HAWK	62	
VAN WARRIOR	22	67
VENTURE STAR	34	2
VERREZANO BRIDGE	121	48
VICTORY ACE	142	99
VIRGINIA STAR	1	
VISHVA BHAKTI	14	
VISHVA PAROG	16	
VISHVA PRAFULLA	28	32
VISHVA SIDDHI	2	
VISHVA VIKRAM	6	
WASHINGTON RAINBOW #2	58	
WASHINGTON TRADER	13	
WECOMA	1	
WELLINGTON STAR	91	
WESER EXPRESS	7	
WESTERN HIGHWAY	23	
WESTERN SUN	12	33
WESTOCEAN	191	
WESTWARD		114
WESTWARD VENTURE	33	45
WESTWOOD MUSKETEER	2	
WILLIAM B. BAUGH	12	12
WILLIAM E. MUSSMAN	23	136
WILLOWBANK	149	
YAMASHIN MARU	100	46
YASHIMA MARU	86	49
YOUNG SCOPE	77	
YOUNG SPROUT	92	152
ZEELANDIA	113	
ZEPHUNTER	10	
ZEUS	4	
ZEYNEP-K	33	39
ZIM GENOVA	33	
ZIM HAIFA	33	
ZIM HONGKONG	35	
ZIM HOUSTON	11	
ZIM IBERIA	59	
ZIM KEELUNG	37	
ZIM MARSEILLES	5	
ZIM MIAMI	38	
ZIM NEW YORK	36	
ZIM SAVANNAH	51	
ZIM TOKYO	27	
ZOELLA LYKES	13	
3EFRS		19

SUMMARY: GRAND TOTAL VIA RADIC 34967
GRAND TOTAL VIA MAIL 67730
TOTAL UNIQUE OBS 86410

BATHY-TESAC Data Received at NMC

January, February and March 1986

This listing represents BATHY-TESAC messages received at the Specialized Oceanographic Center (SOC), located at the U.S. National Meteorological Center (NMC). These ships participate in the collection and exchange of Integrated Global Ocean Services System (IGOSS) Data on the Global Telecommunications System (GTS).

Additional information on this program can be obtained by contacting:

John J. Kundrat, Jr.
National Meteorological Center
Room 206
Camp Spring, Maryland 20233
Phone 301-763-8133

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
ACFT	2	2	0	AIRCRAFT
A8YI	4	4	0	PACBARON
BNSC	58	58	0	XIANG YANG HONG 16
BNUB	48	48	0	XIANG YANG HONG 14
CGDV	246	246	0	W. TEMPLEMAN
CG2683	24	12	12	ALFRED NEEDLER
C7C	1	0	1	OCEAN STATION CHARLIE
C7L	86	86	0	OCEAN STATION LIMA
DBFJ	29	29	0	FRITHJOF
DBFR	18	18	0	ANTHON DOHRN
DCH	3	3	0	ELBE I
DDMA	14	14	0	JEBSEN SOUTHLAND
DFCG	56	56	0	SONNE
DFPU	78	78	0	HANNOVER
DGFR	56	56	0	MONTE OLIVIA
DGLM	30	30	0	MONTE ROSA
DGRL	61	61	0	RIKA
DGSR	34	34	0	MONTE SARMIENTO
DGVK	86	86	0	COLUMBIA VICTORIA
DGZV	90	90	0	COLUMBUS VIRGINIA
DHCW	90	90	0	COLUMBUS WELLINGTON
DNIC	1	1	0	***
DTMW	1	1	0	***
D5CW	3	3	0	SOUTH GLORY
D5NZ	43	43	0	POLYNESIA
ELBX3	1	1	0	PACKING
ELB09	3	3	0	ARCO RESOLUTION
ELXF	1	1	0	KOREAN PRIDE
ELZX	1	1	0	FLAMMULINA
EREA	315	174	141	MONSOON
EREB	214	88	126	VOLNA
EREC	1	0	1	PRYLYV
EREH	39	0	39	PRIBOI
EREI	179	82	97	OCEAN
ERES	115	75	40	VICTOR BUGAEN
ERET	362	202	160	GEORGE OUSHAKOV
EREU	145	96	49	ERNST KRENKEL
FNBA	150	150	0	CRYOS
FNCW	46	46	0	ROUSSEAU
FNGS	31	31	0	LAFAYETTE
FNIB	32	32	0	THALASSA
FNOM	15	15	0	ANGO
FTZJ	1	1	0	***
GACA	6	6	0	***
GDKA	1	1	0	***
GOTC	35	35	0	CALIFORNIA STAR
GOVL	16	16	0	ACT 4
GOVM	60	60	0	DILKARA
GOVN	32	32	0	ACT6
GWUK	4	4	0	STARELLA
GZKA	5	5	0	ACT 3
HCJH	8	8	0	ISLA FLOREANA
HPAN	19	19	0	***
HPEW	30	30	0	PACIFIC ISLANDER
H9BQ	13	13	0	***
JBES	28	28	0	YAMASHIN MARU
JBMS	70	70	0	HIKAWA MARU
JBOA	42	42	0	KEIFU MARU
JCDF	97	97	0	SOYO MARU
JCDT	13	13	0	AMERICA MARU
JCIN	16	16	0	TOKYO MARU
JCLL	70	70	0	LIONS GATE BRIDGE
JCZF	65	65	0	HOTAKA MARU
JDOC	42	42	0	HIEI MARU
JEMM	51	51	0	ASIA MARU
JFDG	62	62	0	SHUMPU MARU
JFZG	89	89	0	HAKUSAN MARU
JGFM	47	47	0	PACIFIC ARROW
JGZK	155	155	0	RYOFU MARU
JHJE	35	35	0	QUEENS WAY BRIDGE

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
JIOW	39	39	0	ALASKA MARU
JJZC	18	18	0	HAKONE MARU
JLRV	26	26	0	PACIFIC TRADER
JNVF	42	42	0	KAIYO MARU
JPQX	58	58	0	CHOFU MARU
JPVB	81	81	0	SEIFU MARU
JQXW	11	11	0	HIERU MARU
JRME	1	1	0	NANSHO MARTU
KCEJ	9	9	0	KNORR
KEOC	26	26	0	EDGAR M. QUEENY
KIYO	14	14	0	EXXON JAMESTOWN
KNBD	12	12	0	DELAWARE II
LOAI	23	23	0	ALMIRANTE IRIZAR
LZTI	31	31	0	***
NAAO	43	43	0	GLACIER
NAFC	14	14	0	***
NADD	49	49	0	JARVIS
NBTM	129	129	0	POLAR STAR
NCAR	3	3	0	CARR
NDWA	12	12	0	MORGENTHAU
NFKQ	3	3	0	SEALIFT ARABIAN SEA
NGDF	11	11	0	MUNRO
NHOC	13	13	0	CURTS
NHPA	5	5	0	STARK
NHTE	10	10	0	ELROD
NHWR	8	8	0	MIDGETT
NIKA	61	61	0	SEALIFT ATLANTIC
NIKL	1	1	0	TAMPA
NIZX	12	12	0	MARSHFIELD
NJOR	11	11	0	GALLATIN
NLVS	12	12	0	RUSH
NMST	54	54	0	MAHLON S. TISDALE
NOTH	1	1	0	HALYBURTON
NRL	12	12	0	***
NSVN	79	79	0	NICHOLAS
NZXF	3	3	0	SAMPSON
ONBI	1	0	1	DART CONTINENT
PGDG	27	27	0	NEDLLOYD KINGSTON
PGDU	44	44	0	NEDLLOYD KIMBERLEY
PGOF	56	56	0	NEDLLOYD KEMBLA
PJYG	19	19	0	OLEANDER
PLAT	185	185	0	PLATFORM
SCOV	3	3	0	TV 244
SCPE	5	5	0	TV 253
SEXQ	1	1	0	TV 278
SHIP	796	796	0	NO SHIP CALL SIGN REC'D
SHPF	3	3	0	TV 281
SJTR	4	4	0	TV 271
SKVP	9	9	0	***
SMZC	3	3	0	***
SMZY	1	1	0	***
UAAH	2	1	1	***
UAAX	65	27	38	VOYKOV
UBNZ	93	93	0	SHULEYKIN AKADEMIK
UEAK	68	32	36	VALERIAN URYVAYEV
UHOS	205	100	105	ACADEMIC KOROLEV
UJFO	140	140	0	MULTANOVSKIY PROF
UMAY	158	75	83	ACADEMIC SHIRSHOV
UMFW	67	53	14	PROF. ZUBOV
UONS	1	1	0	TRUDOVYE RESERVY
UPUI	112	90	22	PROFESSOR VIZE
USOP	11	0	11	NIKOLAI KONONOV
UTNT	7	7	0	ALEKSANDR BORISOV
UUPB	238	125	113	AKADEMIK N. SHOKALSKIY
UUPW	1	1	0	***
UUQR	15	11	4	MOLCHANOV PAVEL PRO
UURB	2	2	0	PAMIR
UVMM	242	159	83	YAKOV GAKKEL
UWEC	190	86	104	KHROMOV PROFESSOR
UZGH	110	74	36	PASSAT
VCBT	49	49	0	CAPE ROGER

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
VC9450	54	54	0	GADUS ATLANTICA
VKCK	44	44	0	STUART
VKCN	77	77	0	CANBERRA
VKCV	121	121	0	DERWENT
VKDA	184	184	0	DARWIN
VKLB	46	46	0	HOBART
VKMK	34	34	0	***
VKML	133	133	0	SNIPE
VKMS	237	237	0	COOK
VKPT	115	115	0	PERTH
VP49	1	1	0	AIRCRAFT SQUADRON
VP56	2	2	0	AIRCRAFT SQUADRON
VXN	239	239	0	AIRCRAFT
WCBN	18	18	0	CHEVRON CALIFORNIA
WECB	70	70	0	MELVILLE
WMVF	50	50	0	ALBATROSS IV
WTDF	235	235	0	T. CROMWELL
WTDK	22	22	0	D.S. JORDAN
WTDM	42	42	0	M.FREEMAN
WTDO	30	30	0	OREGON II
WTED	37	37	0	CHAPMAN
WTEJ	12	12	0	MCARTHUR

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
WTEP	2	2	0	OCEANOGRAPHER
WTER	7	7	0	RESEARCHER
WXQ7334	27	27	0	PETER ANDERSON
WYB8082	9	9	0	DAY STAR
WYL57	4	4	0	DREW FOSS
WYR7512	24	24	0	BALD EAGLE
WYZ31	66	66	0	AGNES FOSS
WZE392	46	46	0	MOANA WAVE
WZL81	5	5	0	WESTWARD
Y3CH	13	0	13	PROF. ALBRECHT PENCK
3FHI2	44	44	0	MOANA PACIFIC
5MCB	5	5	0	PACMERCHANT
5MTA	35	35	0	PACMONARCH
7JBJ	48	48	0	RICHMOND BRIDGE
7JOB	17	17	0	SHINKASHU MARU
7JWN	42	42	0	***
8JNZ	79	79	0	KOFU MARU

TOTAL BATHYS RECEIVED 8740
TOTAL TESACS RECEIVED 1330
TOTAL REPORTS RECEIVED 10070

U.S. NDBC Climatological Data

January, February and March 1986

B U O Y C L I M A T O L O G I C A L D A T A S U M M A R Y

JANUARY 1986			AIR TEMPERATURE (DEG C)									SEA TEMPERATURE (DEG C)									AIR-SEA TEMPERATURE DIFFERENCE (DEG C)								
BUOY	LAT	LONG	OBS	DAYS	MAX	DY	HR	MIN	DY	HR	MEAN	OBS	DAYS	MAX	DY	HR	MIN	DY	HR	MEAN	OBS	DAYS	MAX	DY	HR	MIN	DY	HR	MEAN
41001	34.9N	072.9W	741	31	21.6	03	18	02.4	28	13	14.5	741	31	22.8	01	22	20.0	30	11	21.2	741	31	00.3	19	19	-18.0	28	13	-06.7
41006	29.3N	077.3W	744	31	23.5	05	15	07.5	28	19	17.2	744	31	24.2	04	13	21.6	09	19	22.7	744	31	00.5	05	15	-15.0	28	07	-05.5
41007	34.2N	076.6W	329	14	19.9	19	00	-04.3	28	12	10.8	329	14	20.9	27	03	15.6	31	09	16.6	329	14	02.4	19	13	-23.8	28	07	-07.8
42001	25.9N	089.7W	743	31	25.4	04	22	12.6	28	07	21.1	743	31	26.4	03	22	24.2	28	13	25.1	743	31	-00.6	04	20	-11.8	28	07	-04.1
42002	26.0N	093.5W	743	31	20.8	01	01	11.1	28	11	17.4	743	31	24.7	03	22	21.4	12	08	23.0	743	31	-03.0	01	03	-11.5	27	22	-05.6
42003	26.0N	085.9W	738	31	26.7	10	04	17.3	28	02	23.8	738	31	25.0	25	21	21.2	28	06	22.8	741	31	04.5	10	04	-04.2	28	02	01.0
44004	38.5N	070.7W	741	31	20.3	20	04	-03.5	15	17	09.5	742	31	19.4	25	10	14.6	15	17	16.0	742	31	03.5	19	16	-18.1	15	17	-06.5
44005	42.7N	068.4W	744	31	10.3	20	05	-11.7	15	13	01.9	744	31	07.1	01	01	05.8	31	03	06.4	744	31	04.0	20	05	-17.9	15	13	-04.6
44007	43.5N	070.1W	741	31	09.5	27	13	-17.7	15	10	-01.0	415	18	07.4	01	22	03.5	16	12	05.8	743	31	04.7	27	13	-22.6	15	10	-06.3
44008	40.5N	069.5W	277	12	11.6	03	20	-06.2	08	12	03.9	277	12	08.6	03	23	04.6	10	21	05.8	277	12	03.3	03	18	-12.5	08	13	-02.9
44011	41.1N	066.6W	742	31	12.8	20	14	-06.1	15	17	04.6	742	31	07.6	05	23	03.7	25	23	06.0	743	31	06.1	28	05	-11.6	15	17	-01.3
44012	38.8N	074.6W	734	31	12.4	19	19	-09.3	15	15	02.8	730	31	08.2	18	12	03.6	31	22	05.9	739	31	07.6	19	19	-15.5	15	15	-03.1
44013	42.4N	070.8W	741	31	12.5	18	21	-16.4	15	13	-00.4	741	31	04.9	05	12	01.9	19	21	03.6	741	31	08.9	18	21	-20.6	15	18	-04.0
45001	48.0N	087.6W	742	31	05.0	12	02	-21.8	27	08	-07.2	742	31	02.8	01	02	01.6	31	16	02.3	742	31	02.7	12	02	-24.1	27	08	-09.5
46001	56.3N	148.3W	743	31	06.7	03	19	-00.4	20	07	04.1	743	31	05.4	01	01	04.8	24	18	05.0	743	31	01.4	03	19	-05.3	20	07	-01.0
46002	42.5N	130.3W	742	31	13.5	18	02	08.2	13	16	11.1	742	31	10.9	28	00	10.0	02	14	10.5	742	31	03.2	18	02	-02.3	13	16	00.6
46003	51.9N	155.7W	742	31	06.1	02	19	-02.3	19	12	02.5	742	31	05.7	01	01	04.4	26	19	05.0	743	31	01.0	28	01	-07.1	19	12	-02.5
46004	50.9N	135.9W	279	12	09.3	06	22	05.7	01	06	07.5																		
46006	40.8N	137.6W	744	31	15.2	06	17	09.0	14	07	12.0	744	31	13.9	01	04	11.5	31	20	12.5	744	31	02.8	17	15	-03.5	07	21	-00.5
46010	46.2N	124.2W	299	14	13.7	07	23	04.1	02	09	08.8	297	14	09.5	13	23	07.0	02	03	08.9	310	14	04.8	07	23	-04.2	02	10	-00.1
46011	34.9N	120.9W	742	31	19.6	12	22	10.9	13	16	13.6	742	31	14.8	07	23	12.9	25	08	13.7	742	31	05.5	12	22	-02.8	13	15	-00.1
46012	37.4N	122.7W	740	31	17.2	26	00	10.4	10	16	13.5	740	31	14.0	26	23	12.5	01	17	13.2	740	31	03.7	13	00	-02.8	10	16	00.3
46013	38.2N	123.3W	673	29	15.1	27	02	08.2	11	15	11.7	672	29	12.5	04	03	11.1	01	15	12.2	677	29	02.9	27	02	-04.1	11	15	-00.5
46014	39.2N	124.0W	742	31	15.8	13	00	07.5	07	08	11.6	742	31	12.4	19	05	11.2	06	05	11.6	742	31	04.0	13	00	-03.9	07	08	-00.1
46016	63.3N	170.3W	209	30	09.5	05	15	-23.6	03	15	-17.4																		
46022	40.8N	124.5W	741	31	15.5	13	06	08.1	06	15	11.8	741	31	11.8	08	14	10.3	01	00	11.4	741	31	04.1	13	06	-03.2	06	15	00.4
46023	34.3N	120.7W	741	31	19.7	11	21	11.1	13	15	14.0	740	31	15.5	28	00	13.2	20	12	13.9	742	31	04.9	11	20	-02.8	13	15	00.1
46025	33.6N	119.1W	218	09	19.3	26	22	12.8	30	06	15.4	218	09	17.0	26	23	14.3	30	18	15.2	218	09	02.9	25	17	-02.2	30	06	00.2
46026	37.8N	122.7W	734	31	17.8	31	15	08.6	10	16	12.0	738	31	13.0	31	14	10.7	02	08	12.3	739	31	04.9	31	15	-03.5	12	18	-00.3
46027	41.8N	124.4W	742	31	14.9	13	05	06.7	12	10	10.8	741	31	11.2	06	23	09.4	01	05	10.7	742	31	04.0	13	05	-04.2	12	10	00.1
46028	35.8N	121.9W	743	31	16.0	09	18	10.0	07	17	13.4	743	31	14.6	09	23	12.4	04	06	13.6	743	31	02.3	09	18	-03.8	07	22	-00.3
46029	46.2N	124.2W	568	25	12.8	27	12	05.4	24	16	09.1	564	25	10.1	31	01	08.5	09	01	09.4	577	25	04.1	08	00	-04.3	24	16	-00.2
46030	40.4N	124.5W	744	31	15.2	13	01	08.5	24	19	11.6	744	31	12.7	03	20	11.9	01	09	12.3	744	31	02.6	13	03	-03.7	19	17	-00.7
46035	57.0N	177.7W	742	31	03.6	25	00	-08.2	04	19	-01.2	742	31	04.4	01	01	03.1	29	03	03.7	742	31	00.1	27	02	-12.3	04	19	-04.9
51001	23.4N	162.3W	744	31	23.6	17	02	19.3	17	12	21.8	744	31	23.8	11	00	22.4	03	20	23.1	744	31	00.3	17	02	-03.9	17	12	-01.2
51002	17.2N	157.8W	744	31	25.8	26	03	21.8	27	06	24.2	744	31	27.4	26	00	25.3	17	14	25.7	744	31	-00.2	19	19	-04.1	27	05	-01.4
51003	19.2N	160.8W	730	31	25.4	29	04	21.7	30	18	23.9	732	31	26.5	25	01	24.2	22	23	25.1	741	31	00.6	22	23	-03.5	30	18	-01.1
51004	17.5N	152.5W	742	31	26.2	25	03	21.6	21	16	24.4	742	31	26.4	27	03	25.1	28	17	25.5	742	31	00.1	18	02	-03.7	21	16	-01.1
51005	20.3N	156.1W	742	31	25.0	19	22	21.1	09	12	23.2	742	31	25.3	28	02	23.7	31	08	24.4	742	31	00.8	19	22	-03.3	26	08	-01.2
ALRF1	24.9N	080.6W	743	31	25.0	04	20	07.1	28	12	20.1	743	31	24.1	25	23	19.3	15	11	22.4	743	31	02.8	18	14	-13.6	28	12	-02.3
ALSN6	40.5N	073.8W	741	31	12.3	18	20	-12.8	15	11	01.0																		
BURL1	28.9N	089.4W	741	31	19.4	21	22	02.8	28	10	12.7																		
BUZM3	41.4N	071.0W	742	31	11.2	26	20	-14.9	15	11	01.3																		
CARO3	43.3N	124.4W	743	31	18.9	13	08	03.8	24	15	10.5																		
CHLV2	36.9N	075.7W	739	31	14.7	19	21	-07.3	28	13	04.7	740	31	09.0	02	20	03.5	30	01	07.2	741	31	07.9	19	21	-14.1	28	13	-02.6
CLKN7	34.6N	076.5W	726	31	17.3	18	17	-06.9	28	08	07.6																		
CSBF1	29.7N	085.4W	723	31	18.2	22	18	02.2	06	12	12.5																		
DBLN6	42.6N	079.4W	467	20	10.9	19	08	-17.3	15	12	-02.8																		
DESW1	47.7N	124.5W	744	31	16.6	13	06	02.8	04	15	08.1																		
DISW3	47.1N	090.7W	741	31	05.1	12	01	-19.6	08	07	-07.0																		
DSLN7	35.2N	075.3W	767	31	20.5	19	16	-06.0	28	13	10.1																		
FBIS1	32.7N	079.9W	731	31	18.0	03	18	-06.7	28	02	08.1																		
FFIA2	57.3N	133.6W	744	31	11.1	13	05	00.3	16	16	03.6																		
FPSN7	33.5N	077.6W	742	31	20.1	03	07	-06.3	28	15	11.2																		
GDIL1	29.3N	089.9W	740	31	20.0	21	19	02.2	27	16	12.7	631	31	17.1	23	03	11.7	08	20	14.2	740	31	06.3	29	18	-18.0	28	08	-01.2
GLLN6	43.9N	076.4W	727	31	08.4	19	21	-20.9	14	13	-04.8																		
IOSN3	42.9N	070.6W	739	31	12.5	18	21	-18.2	15	13	-01.0																		
LKWF1	26.6N	080.0W	733	31	26.6	10	21	03.1	28	15	18.9	739	31	23.7	03	03	20.1	28	10	22.5	740	31	03.0	10	21	-17.4	28	15	-03.8
MDRM1	44.0N	068.1W	739	31	09.4	27	15	-18.3	15	13	-00.9																		
MISM1	43.8N	068.9W	741	31	09.2	27	14	-18.3	15	14	-01.0																		
NWPO3	44.6N	124.1W	744	31	17.4	08	06	03.0	24	14	09.3																		
PILM4	48.2N	088.4W	503	22	04.7	12	02	-25.0	27	12	-07.8																		
PTAC1	38.9N	123.7W	743	31	18.3	13	03	04.6	11	16	11.1																		
PTAT2	27.8N	097.1W	743	31	21.1	04	22	03.1	09	14	13.7																		
PTGC1	34.6N	120.7W	726	31	23.0	12	22	10.3	14	13	14.2																		
SBIO1	41.7N	082.8W	722	31	07.9	18	21	-16.5	27	14	-03.1																		
SGNW3	43.8N	087.7W	742	31	06.0	17	02	-19.9	27	13	-05.7	722	31	02.3	24	13	00.0	01	00	00.3	744	31	05.2	12	07	-19.9	27	13	-06.0
SISW1	48.3N	122.9W	743	31	13.8	10	21	03.1	04	13	07.5																		
SJLF1	30.4N	081.4W	741	31	21.1	03	20	-06.8	28	12	11.4																		
SPGF1	26.7N	079.0W	386	22	25.3	05	21	16.8	13	07	20.9																		
SRST2	29.7N	094.1W	744	31	21.1	04	20	01.0	27	13	11.4																		
SVLS1	31.9N	080.7W	734	31	16.8	04	00	-08.1	28	09	09.6	740	31	12.8	02	03	07.9	29	07	11.2	741	31	05.4	18	01	-17.3	28	09	-01.7
TPLM2	38.9N	076.4W	742	31	11.6	03	21	-10.8	28	10	01.1	715	31	04.0	01	06	00.0	28	14	02.1	743	31	09.7	18	18	-11.3	28	08	-00.9
TTIW1	48.4N	124.7W	739	31	15.8	13	07	02.4	02	20	07.8																		
WPOW1	47.7N	122.4W	744	31	11.4	31	01	03.2	02	14	07.1																		

JANUARY 1986			WAVE HEIGHTS (METERS)				FREQUENCY OF WAVE HEIGHTS (%)							
BUOY	LAT	LONG	OBS	MAX	DY HR	MEAN	<1M	1-1.5M	2-2.5M	3-3.5M	4-5.5M	6-7.5M	8-9.5M	>9.5M
41006	29.3N	077.3W	743	7.5	28 01	2.1	0.8	36.4	35.3	20.1	6.9	0.9		
41007	34.2N	076.5W	329	4.5	26 06	2.2	3.0	29.7	29.1	32.2	5.7			
42001	25.9N	089.7W	740	4.5	08 18	1.3	36.3	39.6	7.1	13.6	3.3			
42002	26.0N	093.5W	737	4.5	05 15	1.3	29.1	48.8	7.4	9.9	4.6			
42003	26.0N	085.9W	734	4.5	05 23	1.3	40.0	32.5	14.3	11.1	1.9			
44004	38.5N	070.7W	741	7.5	27 08	2.7		16.5	32.6	25.2	22.8	2.6		
44005	42.7N	068.4W	743	5.5	26 17	2.4	0.2	16.0	38.2	24.8	18.5			
44007	43.5N	070.1W	725	5.5	26 12	1.4	20.1	51.5	16.2	9.1	2.8			
44008	40.5N	069.5W	272	6.0	06 15	2.6	0.3	16.9	44.4	24.6	12.6	0.7		
44011	41.1N	066.6W	741	8.5	28 08	3.2	0.1	10.6	29.5	30.3	21.7	7.1	0.4	
45001	48.0N	087.6W	728	4.5	09 05	1.5	26.0	41.7	20.6	5.6	5.9			
46001	56.3N	148.3W	739	7.5	13 08	3.6		4.1	25.6	31.6	32.4	6.2		
46002	42.5N	130.3W	742	8.5	16 22	4.2			15.2	24.3	47.1	12.5	0.6	
46003	51.9N	155.7W	739	9.5	22 11	3.8		1.0	21.1	31.9	35.7	7.4	2.7	
46004	50.9N	135.9W	740	10.0	07 14	4.5			[illegible]	[illegible]	40.0	[illegible]	3.3	0.1
46006	40.8N	137.6W	743	11.0	18 13	4.7			8.6	19.1	47.9	19.7	4.3	0.2
46010	46.2N	124.2W	254	6.0	06 07	3.3		5.1	19.6	40.9	33.8	0.3		
46011	34.9N	120.9W	741	5.5	15 18	2.3		24.9	49.2	17.2	8.8			
46012	37.4N	122.7W	738	6.0	15 13	2.4		22.8	39.8	28.8	8.2	0.1		
46013	38.2N	123.3W	649	7.0	15 08	2.6		17.5	40.0	28.6	13.2	0.4		
46014	39.2N	124.0W	742	7.5	15 08	2.6		9.7	36.5	28.0	24.7	0.4		
46022	40.8N	124.5W	738	6.5	15 06	3.2		3.1	38.4	29.8	27.3	1.2		
46023	34.3N	120.7W	735	5.0	14 22	2.4		21.2	48.0	21.0	9.6			
46025	33.6N	119.1W	215	2.0	23 23	1.1	24.6	57.2	18.1					
46026	37.8N	122.7W	712	5.5	15 09	2.2		34.6	42.9	15.5	6.7			
46027	41.8N	124.4W	740	6.0	15 09	3.0		11.6	33.1	31.3	23.5	0.4		
46028	35.8N	121.9W	742	5.5	23 15	2.4		21.2	44.0	26.0	8.8			
46035	57.0N	177.7W	739	7.5	30 01	3.1		23.0	20.2	25.7	23.5	7.4		
51001	23.4N	162.3W	742	5.0	06 21	2.6		6.0	54.8	31.2	7.8			
51002	17.2N	157.8W	743	4.0	01 00	2.6		0.9	65.9	25.9	1.0			
51003	19.2N	160.8W	741	4.0	07 09	2.4		3.2	72.6	22.4	1.7			
51004	17.5N	152.5W	741	4.5	08 11	2.6		3.9	56.8	35.8	3.3			
51005	20.3N	156.1W	740	3.5	01 18	1.5		67.5	27.7	4.7				
FBIS1	32.7N	079.9W	123	0.0	00 00	0.0								30.0

JANUARY 1986			PRESSURE (MB)							WIND SPEEDS (KNOTS)				MEAN WIND SPEED (KNOTS)								
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	MAX	DY HR	DIR	N	NE	E	SE	S	SW	W	NW	TOTAL
41001	34.9N	072.9W	741	31	1035.9	16 15	993.2	27 21	1018.9	740	32	05 10	210	15.4	14.4	11.0	16.2	15.7	17.7	17.3	15.2	16.1
41006	29.3N	077.3W	744	31	1032.7	16 15	1004.0	26 21	1020.1	741	34	27 23	260	11.2	12.2	10.5	12.6	12.1	12.9	16.0	13.4	13.0
41007	34.2N	076.5W	329	14	1032.4	31 15	997.5	27 19	1016.9	305	33	30 05	270	16.3	7.3	17.0	19.7	14.0	16.3	19.7	15.3	17.3
42001	25.9N	089.7W	743	31	1027.1	15 16	1012.1	10 11	1019.9	735	28	08 09	030	11.8	10.4	13.5	8.9	10.2	14.6	11.7	15.3	12.1
42002	26.0N	093.5W	743	31	1028.6	05 16	1012.5	07 20	1020.8	743	32	09 02	080	19.5	16.3	17.3	11.2	12.0	10.0	9.8	12.8	14.5
42003	26.0N	085.9W	737	31	1028.7	16 15	1011.2	10 20	1020.6	738	34	08 02	030	14.8	12.3	14.5	10.4	10.3	12.1	10.7	20.5	14.0
44004	38.5N	070.7W	742	31	1035.9	25 04	988.4	27 12	1017.3	220	33	27 05	170	18.4	19.6	17.1	22.6	25.4	17.2	19.9	15.6	19.4
44005	42.7N	068.4W	743	31	1041.8	25 08	984.3	28 09	1013.9	741	30	06 20	260	13.8	8.6	12.7	17.6	14.1	15.4	18.3	17.1	16.2
44007	43.5N	070.1W	740	31	1044.0	25 04	986.9	28 09	1014.5	723	33	12 14	220	14.4	10.3	14.8	21.6	17.8	17.9	15.7	15.3	16.2
44008	40.5N	069.5W	277	12	1031.3	09 02	995.8	05 18	1016.5	269	35	06 17	260	11.6	2.0	13.5	16.9	13.4	17.3	20.1	17.6	17.9
44011	41.1N	066.6W	740	31	1039.8	25 15	986.1	28 07	1015.0	740	35	30 12	060	17.8	19.2	16.3	16.1	12.9	13.9	21.0	17.8	17.5
44012	38.8N	074.6W	732	31	1038.2	08 16	991.5	27 06	1018.9	716	35	14 03	310	16.4	15.8	15.3	12.5	14.1	14.4	15.3	17.6	15.5
44013	42.4N	070.8W	740	31	1041.8	25 08	984.9	27 11	1015.1	735	31	06 19	250	12.6	6.8	12.3	15.4	11.4	13.7	16.9	15.2	14.6
45001	48.0N	087.6W	733	31	1039.2	07 21	983.5	12 09	1015.5													
46001	56.3N	148.3W	743	31	1005.1	28 02	964.6	13 18	987.4	740	32	07 07	330	12.9	13.0	17.1	16.1	12.2	13.0	14.5	18.9	14.8
46002	42.5N	130.3W	742	31	1025.4	24 08	984.5	31 14	1009.2	737	34	12 23	160	4.8	9.7	18.0	17.2	17.0	15.1	16.3	8.5	16.1
46003	51.9N	155.7W	742	31	1005.3	01 22	965.4	12 00	986.7	739	39	22 05	270	15.5	12.8	17.2	14.6	12.9	13.9	17.3	20.0	16.7
46004	50.9N	135.9W	484	22	1014.6	28 06	975.8	31 23	999.8	246	31	06 19	140	7.2	2.5	14.5	19.3	15.3	16.3	13.6	17.2	16.5
46006	40.8N	137.6W	744	31	1022.9	01 09	974.5	31 01	1005.3	742	44	18 12	210	7.8	9.3	4.0	16.9	20.8	16.8	18.7	12.8	18.1
46010	46.2N	124.2W	305	14	1032.3	06 18	1002.0	02 23	1016.4	096	23	01 05	180			15.1	10.1	15.9	11.0	14.2	14.5	14.0
46011	34.9N	120.9W	742	31	1030.1	08 18	1005.9	30 15	1020.2	717	26	29 15	150	7.9	5.3	4.1	12.1	13.1	6.2	4.2	10.3	09.2
46012	37.4N	122.7W	740	31	1030.0	06 18	1003.1	31 15	1019.7	740	32	29 17	140	7.9	6.3	5.1	12.6	12.7	7.6	4.1	8.3	09.5
46013	38.2N	123.3W	675	29	1031.0	06 18	1006.7	29 12	1021.2	629	26	04 09	090	5.9	5.3	10.2	10.1	11.5	9.6	4.7	8.8	09.4
46014	39.2N	124.0W	742	31	1030.2	06 18	999.5	31 14	1018.8	713	32	30 04	130	5.2	3.8	6.4	15.3	12.4	5.0	4.2	7.9	11.2
46016	63.3N	170.3W	247	31	1020.0	17 21	984.8	04 15	1005.2	088	12	01 00	150	1.0			3.7	2.6	4.2		1.8	02.9
46017	60.3N	172.3W	247	31	1020.1	17 21	980.4	04 18	1001.4	247	34	30 06	050	19.0	20.7	20.5	20.3	21.0	7.0	10.7	12.4	18.9
46022	40.8N	124.5W	741	31	1029.5	06 18	997.9	31 14	1017.1	719	34	15 05	160	7.0	6.0	4.8	11.3	17.7	11.9	4.7	5.9	13.5
46023	34.3N	120.7W	741	31	1029.8	08 18	1007.3	30 11	1020.2	729	28	30 03	100	8.5	4.4	12.3	13.0	9.8	5.5	6.0	12.6	11.5
46025	33.6N	119.1W	215	09	1022.1	23 19	1008.3	30 12	1015.8	201	24	30 04	080	2.3	3.5	9.6	8.0	6.9	3.3	5.4	5.9	07.1
46026	37.8N	122.7W	737	31	1031.4	06 18	1004.3	31 14	1020.7	730	26	29 16	140	3.3	10.0	10.6	13.6	13.1	7.9	6.1	7.7	10.2
46027	41.8N	124.4W	741	31	1031.1	06 17	999.0	31 13	1017.7	734	39	15 08	140	7.6	3.9	4.6	12.1	17.2	14.0	5.8	5.6	11.7
46028	35.8N	121.9W	743	31	1031.1	17 19	1005.6	30 14	1020.6	704	25	31 13	140	7.4	2.7	4.7	11.7	9.3	3.8	4.8	9.7	08.7
46029	46.2N	124.2W	567	25	1031.0	24 19	996.7	30 13	1014.0	573	35	17 03	210	6.5	9.6	11.1	9.7	17.0	13.8	7.1	4.3	12.6
46030	40.4N	124.5W	744	31	1029.3	06 18	998.6	31 15	1017.7	720	39	16 00	140	8.7	5.6	3.7	19.0	13.9	6.0	5.0	3.7	14.9
46035	57.0N	177.7W	742	31	1022.9	17 23	974.6	26 04	1000.1	738	32	30 17	040	14.4	16.4	17.4	17.5	16.7	14.2	17.1	16.6	16.2
51001	23.4N	162.3W	744	31	1025.5	06 21	1007.3	17 01	1016.6	724	20	06 14	010	8.8	10.0	11.6	7.9	5.9	9.8	10.9	8.7	09.5
51002	17.2N	157.8W	744	31	1019.7	06 21	1008.9	25 02	1014.2	729	23	01 08	070	6.6	13.1	14.7	6.2	5.3	6.3		6.9	12.8
51003	19.2N	160.8W	520	23	1022.2	06 20	1009.1	25 02	1014.7													
51004	17.5N	152.5W	742	31	1018.5	13 19	1007.7	25 02	1013.4	730	22	01 07	050	7.2	14.3	12.3	8.0	3.8	3.5	4.0	3.4	11.6
51005	20.3N	156.1W	742	31	1019.7	06 20	1007.0	25 01	1013.9	741	33	01 21	040	5.2	16.7	12.2	3.4	5.9	7.2	6.3	2.2	13.1
ALRF1	24.9N	080.6W	743	31	1028.3	16 15	1010.1	26 21	1020.1	683	37	26 22	300	11.3	11.4	14.9	13.0	10.8	13.7	12.0	13.6	12.8
ALSN6	40.5N	073.8W	740	31	1039.1	25 03	988.4	27 08	1017.7	713	41	28 10	330	18.2	13.2	10.8	21.7	15.0	15.7	15.7	18.2	16.9
BURL1	28.9N	089.4W	741	31	1029.1	16 15	1014.0	01 00	1021.7	681	35	05 12	330	13.4	10.0	9.7	8.8	10.1	11.0	13.4	16.3	12.4
BUZM3	41.4N	071.0W	742	31	1041.1	25 04	985.7	27 09	1016.3	732	42	10 06	230	14.0	10.6	19.7	18.5	15.8	20.8	19.3	17.4	18.3
CARO3	43.3N	124.4W	743	31	1032.0	06 17	998.7	30 04	1016.3	738	40	08 07	200	5.6	3.7	3.8	6.2	15.6	14.2	5.9	2.1	10.5
CHLV2	36.9N	075.7W	741	31	1039.2	08 16	994.2	27 20	1019.6	703	33	28 02	260	17.5	17.1	10.2	17.0	15.6	15.0	16.9	17.8	16.4
CLKN7	34.6N	076.5W	735	31	1039.4	09 02	997.2	27 19	1020.5	685	34	28 02	270	12.5	9.6	3.8	8.8	7.4	10.1	13.3	12.1	11.1
CSBF1	29.7N	085.4W	744	31	1031.0	09 04	1009.2	10 20	1020.8	712	28	27 10	290	4.3	4.3	3.8	2.4	5.8	7.3	9.4	8.5	05.5
DBLN6	42.6N	079.4W	468	20	1037.2	24 14	996.5	20 09	1016.1	465	33	22 17	240	9.1	7.2	6.4	6.8	7.4	16.8	15.3	13.1	11.8
DESW1	47.7N	124.5W	742	31	1031.6	06 18	990.6	17 03	1013.1	740	51	06 02	250	2.6	6.1	7.0	19.2	23.9	20.0	17.6	8.9	16.9
DISW3	47.1N	090.7W	741	31	1041.6	07 16	991.7	12 07	1017.0	725	40	12 12	280	14.0	11.1	10.2	5.7	7.8	18.1	17.0	17.5	13.9
DSLN7	35.2N	075.3W	718	30	1038.2	09 00	995.3	27 05	1020.1	690	42	26 09	170	19.7	13.3	20.7	22.0	20.5	20.4	18.4	16.2	18.7
FBIS1	32.7N	079.9W	744	31	1038.6	09 02	1003.7	26 20	1021.4	720	22	08 06	050	5.9	9.0	7.2	3.6	2.8	8.1	5.7	6.0	07.1
FFIA2	57.3N	133.6W	744	31	1020.3	28 18	985.8	13 15	1003.5	653	35	07 18	140	10.9	5.1	4.5	18.2	11.9	2.7	3.2	4.3	13.0
FPSN7	33.5N	077.6W	742	31	1038.2	09 04	999.7	27 17	1020.4	705	41	20 04	260	15.5	13.2	8.8	12.9	13.1	18.5	20.6	16.6	16.3
GDIL1	29.3N	089.9W	740	31	1029.4	09 04	1013.8	01 00	1021.9	686	30	05 10	350	12.6	12.3	7.4	5.3	6.1	7.1	8.6	12.0	10.0
GLLN6	43.9N	076.4W	728	31	1039.4	08 13	991.5	20 18	1015.9	709	43	06 06	250	8.6	9.1	8.7	14.8	18.5	19.3	18.6	13.6	16.0
IOSN3	42.9N	070.6W	738	31	1041.9	25 04	985.1	27 11	1014.2	729	38	27 11	130	12.3	10.0	17.4	23.1	18.9	18.0	18.0	15.6	17.4
LKWF1	26.6N	080.0W	739	31	1029.2	16 15	1006.3	26 21	1019.6	725	28	09 05	090	8.2	9.6	14.3	8.6	10.4	7.0	5.3	6.9	08.6
MDRM1	44.0N	068.1W	738	31	1044.2	25 04	982.9	28 10	1013.6	725	42	26 12	130	18.4	12.7	21.2	26.7	19.0	21.0	20.5	21.5	21.0
MISM1	43.8N	068.9W	741	31	1044.1	25 05	984.8	28 10	1013.8	729	40	12 19	190	16.1	11.8	21.2	27.6	20.1	21.7	21.2	20.9	21.0
NWPO3	44.6N	124.1W	744	31	1032.6	06 17	998.4	31 17	1015.7	740	43	18 23	190	5.4	6.6	8.1	5.4	17.4	15.9	6.7	6.0	11.3
PILM4	48.2N	088.4W	502	22	1033.3	24 00	983.6	12 06	1015.1	468	45	24 22	130	9.8	8.3	15.7	24.5	15.1	16.3	17.4	13.6	14.6
PTAC1	38.9N	123.7W	743	31	1030.2	06 17	1000.5	31 14	1018.9	731	27	30 02	150	4.1	1.6	3.6	10.0	11.0	4.4	1.7	6.0	08.6
PTAT2	27.8N	097.1W	743	31	1034.1	05 15	1012.0	06 22	1022.0	685	33	08 02	020	13.9	8.6	7.1	8.8	8.2	4.4	4.8	10.2	09.8
PTGC1	34.6N	120.7W	726	31	1029.9	08 18	1006.0	30 10	1019.8	585	40	30 01	140	10.9	3.2	3.4	14.1	7.3	1.8	3.3	13.2	10.4
SBIO1	41.7N	082.8W	726	31	1043.2	08 16	1002.8	05 06	1019.4	704	31	27 07	350	9.9	4.0	5.4	9.8	10.5	12.8	14.1	16.3	12.5
SGNW3	43.8N	087.7W	743	31	1043.4	08 04	998.7	12 13	1017.7	727	30	24 21	150	12.6	14.4	16.0	19.6	12.5	9.9	10.8	12.6	12.0
SISW1	48.3N	122.9W	743	31	1033.0	06 18	996.4	17 03	1016.3	736	42	17 06	160	3.3	5.9	7.7	17.1	18.5	6.5	13.4	6.1	12.4
SJLF1	30.4N	081.4W	741	31	1033.5	09 03	1007.4	26 19	1021.4	685	31	08 18	030	11.1	11.1	5.2	3.8	7.2	6.5	8.1	9.2	08.9
SPGF1	26.7N	079.0W	397	22	1030.1	16 16	1009.6	11 10	1020.6	397	30	09 04	100	11.6	9.3	13.4	5.5	4.9	4.6	3.3	9.5	09.5
SRST2	29.7N	094.1W	744	31	1032.9	05 15	1014.3	07 09	1022.5	695	24	08 03	040	9.4	9.3	8.6	8.6	8.2	7.8	5.8	8.0	08.6
STDM4	47.2N	087.2W								669	46	12 15	350	21.5	12.4	10.4	16.6	21.4	15.3	18.9	15.9	17.6
SVLS1	31.9N	080.7W	740	31	1036.9	09 02	1005.5	19 20	1021.3	713	40	27 17	280	14.4	17.7	10.0	6.2	13.5	14.1	17.1	14.9	15.3
TPLM2	38.9N	076.4W	743	31	1039.2	08 16	992.1	20 20	1018.1	724	31	28 02	290	10.3	7.8	6.3	8.9	9.2	8.1	11.6	11.3	10.0
TTIW1	48.4N	124.7W	738	31	1032.1	06 19	990.4	17 04	1013.2	739	43	18 09	170	5.0	16.0	20.0	12.8	23.3	19.6	18.6	7.9	19.0
WPOW1	47.7N	122.4W	744	31	1032.5	06 18	998.1	16 22	1014.2	728	38	17 05	200	6.3	3.6	3.1	5.8	11.6	12.1	1.8	2.3	08.5

JANUARY 1986			TOTAL FREQUENCY OF WIND SPEEDS (%)							TOTAL FREQUENCY OF WIND DIRECTIONS (%)							
BUOY	LAT	LONG	CALM	<4KT	4-10KT	11-21KT	22-33KT	34-47KT	>47KT	N	NE	E	SE	S	SW	W	NW
41001	34.9N	072.9W		1.4	20.7	55.5	22.4			14.0	2.8	3.4	5.9	16.0	16.1	23.9	17.9
41006	29.3N	077.3W		7.0	27.3	55.7	9.9	0.1		8.7	16.7	11.8	10.3	7.1	12.0	23.5	9.9
41007	34.2N	076.5W	1.0	4.3	15.1	46.2	34.4			19.4	1.8	2.2	10.2	4.4	17.5	30.7	13.8
42001	25.9N	089.7W		7.3	37.8	42.2	12.7			17.9	9.8	18.6	15.9	10.5	4.5	3.8	18.9
42002	26.0N	093.5W		1.7	30.0	49.7	18.6			19.4	14.2	13.6	18.5	25.6	6.1	1.3	1.2
42003	26.0N	085.9W		1.8	36.6	44.7	16.7	0.3		17.8	16.8	26.7	9.8	7.7	5.3	3.2	12.8
44004	38.5N	070.7W		2.3	5.9	55.9	35.9			13.0	15.0	6.3	5.8	10.7	8.6	26.4	14.3
44005	42.7N	068.4W		2.4	14.4	61.9	21.2			9.6	2.4	1.9	11.1	9.1	20.4	23.7	21.8
44007	43.5N	070.1W	1.2	2.5	19.9	56.0	21.6			11.5	4.8	2.6	5.9	6.1	22.5	27.6	18.9
44008	40.5N	069.5W	0.4	2.2	7.4	64.7	25.3	0.4		6.6	0.1	0.6	8.0	4.4	9.1	39.8	31.5
44011	41.1N	066.6W		2.7	14.6	54.3	28.2	0.1		8.4	4.0	3.8	11.6	12.0	12.8	29.6	18.0
44012	38.8N	074.6W	0.8	0.8	22.9	63.5	11.9	0.8		10.8	4.3	3.8	8.1	18.8	12.6	16.1	25.3
44013	42.4N	070.8W	2.2	3.0	26.9	56.9	13.2			4.5	0.7	3.5	10.3	12.3	23.7	25.4	19.6
46001	56.3N	148.3W		3.4	25.3	54.3	17.0			6.8	14.0	19.3	20.5	12.1	13.4	8.6	5.4
46002	42.5N	130.3W		3.1	17.0	60.8	18.9	0.3		1.5	1.7	5.1	21.7	36.0	19.7	11.3	3.2
46003	51.9N	155.7W		4.3	23.1	41.5	29.2	1.8		12.2	5.1	8.9	6.3	6.2	11.5	23.5	26.2
46004	50.9N	135.9W		1.6	19.5	53.3	25.6			3.8	0.6	1.2	35.2	30.6	18.1	6.5	4.1
46006	40.8N	137.6W		1.6	17.7	47.2	32.1	1.5		1.3	0.2	0.1	11.5	30.2	24.3	25.7	6.8
46010	46.2N	124.2W		3.1	26.0	64.6	6.3					40.1	7.3	19.8	19.5	12.8	0.5
46011	34.9N	120.9W		16.3	46.3	35.1	2.2			21.0	9.2	7.2	14.8	10.2	1.4	2.9	33.2
46012	37.4N	122.7W		17.3	44.1	33.1	5.5			16.0	6.2	8.8	22.2	23.0	4.8	5.4	13.5
46013	38.2N	123.3W		15.1	43.1	40.7	1.1			6.6	4.6	36.5	17.8	12.4	4.8	3.1	14.3
46014	39.2N	124.0W		13.0	39.7	37.7	9.5			6.0	4.5	10.3	41.3	22.8	4.2	3.9	7.0
46016	63.3N	170.3W		67.0	31.8	1.1				21.3			58.8	9.9	2.8		7.1
46017	60.3N	172.3W		4.5	10.9	48.2	35.6	0.8		34.5	30.7	9.8	11.8	0.6	1.3	2.0	9.2
46022	40.8N	124.5W		8.2	34.5	38.5	18.6	0.1		6.6	4.9	5.9	17.9	50.7	10.7	1.6	1.6
46023	34.3N	120.7W		7.3	39.1	50.5	3.2			12.7	1.8	10.4	10.7	3.5	1.9	3.0	55.9
46025	33.6N	119.1W		26.9	54.2	16.9	2.0			4.1	5.2	27.9	20.9	13.7	2.2	11.8	14.2
46026	37.8N	122.7W		10.4	44.1	43.6	1.9			4.1	20.6	25.2	11.8	16.7	3.3	5.3	13.0
46027	41.8N	124.4W	7.4	9.5	46.2	28.5	15.3	0.5		3.6	7.0	16.9	29.2	33.0	7.4	0.9	2.1
46028	35.8N	121.9W		20.5	45.3	32.4	1.8			8.0	1.8	5.7	20.7	11.4	5.0	9.3	38.2
46029	46.2N	124.2W	0.7	2.8	39.1	49.2	8.7	0.2		0.9	3.0	39.0	8.4	29.2	12.7	3.9	2.8
46030	40.4N	124.5W	5.1	7.5	28.1	39.7	23.6	1.1		6.3	6.9	1.9	53.0	25.5	4.1	1.2	1.1
46035	57.0N	177.7W		3.3	23.3	46.6	26.8			25.0	16.9	13.0	12.4	5.7	2.8	5.9	18.4
51001	23.4N	162.3W		9.9	48.5	41.6				14.7	19.8	17.8	12.1	7.5	10.6	10.2	7.3
51002	17.2N	157.8W		5.8	24.6	68.3	1.4			5.1	31.2	52.1	9.4	0.9	0.4		0.9
51004	17.5N	152.5W		10.3	23.4	66.2	0.1			4.4	38.9	35.7	11.6	1.9	2.4	4.1	0.9
51005	20.3N	156.1W	3.4	6.1	34.1	52.0	7.8			0.8	52.5	22.9	1.9	6.4	10.7	4.5	0.3
ALRF1	24.9N	080.6W	0.7	2.8	37.8	48.6	10.7	0.1		20.7	15.1	22.3	8.5	4.2	4.5	9.7	14.9
ALSN6	40.5N	073.8W	1.0	3.5	15.4	53.6	26.6	0.8		18.1	6.8	2.3	5.8	5.9	11.9	18.7	30.4
BURL1	28.9N	089.4W	1.0	5.1	38.3	46.0	10.3	0.3		19.0	15.5	11.9	7.7	7.7	4.9	11.3	22.1
BUZM3	41.4N	071.0W	1.6	3.1	13.4	46.7	34.2	2.6		5.3	4.2	5.2	8.5	8.6	23.6	26.5	18.2
CARO3	43.3N	124.4W	6.4	17.8	42.4	25.5	14.2	0.1		1.7	7.4	9.1	25.6	38.3	14.3	2.6	1.0
CHLV2	36.9N	075.7W	2.0	3.1	16.2	56.8	23.9			21.6	3.6	3.2	5.3	17.6	17.8	17.7	13.2
CLKN7	34.6N	076.5W	1.6	11.5	39.0	43.1	6.3	0.1		21.2	9.5	1.5	5.1	10.3	17.8	21.9	12.8
CSBF1	29.7N	085.4W	7.0	33.0	56.0	10.0	1.0			14.5	26.9	18.3	5.4	4.9	4.4	12.0	13.6
DBLN6	42.6N	079.4W	2.2	10.8	40.0	36.6	12.7			7.0	6.2	3.7	7.5	23.0	26.5	16.1	10.0
DESW1	47.7N	124.5W	1.5	7.2	25.3	36.1	24.1	7.2	0.3	2.0	8.6	9.3	53.3	12.7	4.9	7.0	2.3
DISW3	47.1N	090.7W	2.6	8.4	31.3	40.3	18.9	1.1		7.3	8.1	11.2	5.5	14.9	21.4	12.5	19.1
DSLN7	35.2N	075.3W	0.1	2.3	19.1	38.3	38.0	2.3		18.5	3.4	1.6	5.1	8.6	13.9	30.0	18.8
FBIS1	32.7N	079.9W	2.5	26.5	49.3	23.8	0.3			10.5	28.2	8.1	2.0	2.0	14.9	18.0	16.3
FFIA2	57.3N	133.6W	6.0	11.8	31.7	39.1	16.5	0.9		13.2	13.2	7.6	46.5	16.0	1.8	0.8	0.8
FPSN7	33.5N	077.6W	2.3	6.5	21.7	41.0	28.8	2.0		22.1	9.4	5.8	8.9	5.9	15.4	23.0	9.6
GDIL1	29.3N	089.9W	2.5	11.7	51.0	31.0	6.3			15.3	25.7	16.1	5.4	5.9	8.7	8.7	14.2
GLLN6	43.9N	076.4W	2.7	5.5	28.2	43.4	21.7	1.1		10.3	12.4	5.3	5.5	18.3	11.6	17.5	19.1
IOSN3	42.9N	070.6W	0.5	1.9	19.1	50.1	26.2	2.7		5.3	3.2	2.5	8.7	9.5	24.1	29.3	17.3
LKWF1	26.6N	080.0W	1.9	13.0	57.2	25.7	4.1			9.7	8.0	18.3	3.5	9.1	8.4	13.6	29.3
MDRM1	44.0N	068.1W	0.3	1.7	9.9	43.3	36.1	9.0		10.6	2.8	3.8	11.0	7.7	16.6	22.1	25.3
MISM1	43.8N	068.9W		0.1	10.7	42.1	38.3	8.8		7.8	3.3	3.9	9.5	8.8	21.5	22.8	22.5
NWPO3	44.6N	124.1W	3.1	9.6	46.8	32.4	9.7	1.5		0.6	1.8	45.8	6.3	26.8	13.0	5.0	0.7
PILM4	48.2N	088.4W	0.4	7.3	34.4	35.9	18.6	3.8		24.1	4.3	3.8	10.4	5.7	10.7	15.5	25.5
PTAC1	38.9N	123.7W	13.4	22.7	40.4	32.7	3.1			9.1	7.3	6.6	36.0	32.6	3.1	1.6	2.5
PTAT2	27.8N	097.1W	2.2	12.0	48.9	34.7	4.4			26.1	15.7	9.5	18.8	10.1	4.1	2.7	13.0
PTGC1	34.6N	120.7W	10.1	22.1	31.6	35.0	11.1	0.2		42.7	4.9	1.9	18.9	17.8	1.2	1.1	11.5
SBIO1	41.7N	082.8W	2.7	8.4	34.1	45.7	11.8			10.5	1.7	3.5	6.8	11.0	29.7	17.2	19.5
SGNW3	43.8N	087.7W	1.1	7.8	36.6	47.0	8.5			6.1	1.9	1.2	5.0	7.9	23.8	24.6	29.6
SISW1	48.3N	122.9W	3.8	9.2	39.1	29.9	19.6	2.2		1.2	9.2	17.3	37.4	16.6	3.0	11.9	3.4
SJLF1	30.4N	081.4W	3.2	15.2	55.2	24.7	5.0			21.8	16.1	6.4	3.4	3.4	10.4	23.4	15.1
SPGF1	26.7N	079.0W	8.8	14.4	43.1	38.8	3.8			3.8	14.5	33.6	7.4	8.1	10.8	2.9	18.8
SRST2	29.7N	094.1W	1.6	8.9	64.5	25.6	1.0			16.5	17.2	14.2	14.7	15.7	9.0	3.2	9.5
STDM4	47.2N	087.2W	0.6	1.9	19.3	49.3	26.3	3.1		20.5	8.9	5.5	4.1	10.5	6.8	20.3	23.4
SVLS1	31.9N	080.7W	0.6	3.9	25.9	48.1	21.0	1.0		9.1	27.3	9.5	1.4	6.8	13.7	21.2	10.9
TPLM2	38.9N	076.4W	4.1	9.5	44.6	42.4	3.5			7.4	3.1	3.9	8.3	21.0	10.3	19.3	26.7
TTIW1	48.4N	124.7W	0.5	1.2	17.5	41.7	34.6	5.0		0.3	3.2	50.4	16.1	16.2	5.7	7.3	0.8
WPOW1	47.7N	122.4W	7.6	24.6	47.0	21.6	6.3	0.5		9.1	15.3	0.5	18.2	45.7	7.4	2.1	1.6

FEBRUARY 1986			AIR TEMPERATURE (DEG C)						SEA TEMPERATURE (DEG C)						AIR-SEA TEMPERATURE DIFFERENCE (DEG C)					
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN
32301	10.0N	105.0W	189	08	25.5	28 18	24.2	25 13	25.0	189	08	26.1	24 22	25.3	21 05	25.7	189	08	-00.1	21 05	-01.5	25 13	-00.7
32302	18.0N	085.1W	670	28	22.7	16 17	19.1	06 12	21.7	671	28	23.3	11 21	21.3	01 03	22.3	671	28	00.4	18 14	-02.7	06 12	-00.7
41001	34.9N	072.9W	670	28	22.9	22 06	04.2	13 20	15.7	670	28	24.6	23 06	19.4	16 09	21.0	671	28	01.0	07 10	-16.1	26 05	-05.3
41004	32.6N	078.9W	673	28	21.4	18 06	03.2	13 17	15.7	673	28	20.6	02 20	17.1	20 03	19.2	675	28	01.8	20 02	-16.7	13 17	-03.5
41006	29.3N	077.3W	668	28	24.1	11 15	12.6	14 06	20.5	668	28	24.5	03 21	22.0	28 23	22.9	668	28	01.0	11 13	-09.7	14 06	-02.4
41007	34.2N	076.5W	697	28	20.6	21 22	01.0	13 19	13.1	697	28	20.3	09 22	15.1	05 16	17.8	697	28	03.8	05 07	-17.6	13 19	-04.7
42001	25.9N	089.7W	670	28	24.8	18 22	14.7	12 13	22.1	670	28	24.7	21 20	23.5	05 11	24.2	670	28	00.9	05 14	-09.4	12 13	-02.1
42002	26.0N	093.5W	670	28	20.9	22 18	11.3	12 06	18.2	670	28	25.6	22 21	21.7	24 12	23.1	671	28	-02.7	16 16	-11.6	11 22	-04.8
42003	26.0N	085.9W	667	28	27.6	06 09	19.5	12 22	25.2	668	28	25.2	20 20	21.8	28 23	23.0	670	28	04.4	04 12	-03.7	12 22	02.1
42007	30.1N	088.9W	221	10	19.2	27 21	06.8	23 14	15.1	221	10	15.7	27 21	13.7	19 18	14.5	222	10	04.6	19 23	-07.8	28 23	00.6
44004	38.5N	070.7W	670	28	19.3	05 10	00.2	26 16	09.1	670	28	22.4	11 16	13.0	28 11	17.8	671	28	01.6	18 20	-20.9	13 17	-08.7
44005	42.7N	068.4W	664	28	07.6	22 02	-05.5	07 08	00.1	664	28	06.0	02 15	03.9	25 13	05.4	665	28	02.3	22 02	-11.0	07 08	-05.3
44007	43.5N	070.1W	657	28	04.2	02 13	-09.7	07 06	-02.4														
44008	40.5N	069.5W	344	15	10.5	22 02	-05.0	26 17	02.3	345	15	05.9	15 09	04.9	14 14	05.3	346	15	05.1	22 02	-10.1	26 17	-03.0
44011	41.1N	066.6W	562	24	11.7	22 03	-02.9	13 16	02.8	562	24	16.6	24 10	04.1	03 18	05.4	562	24	07.3	22 03	-12.8	24 07	-02.7
44012	38.8N	074.6W	653	28	09.3	02 22	-04.9	13 12	02.0	653	28	05.0	02 20	01.6	14 11	03.4	663	28	04.7	18 02	-07.9	12 12	-01.5
44013	42.4N	070.8W	671	28	06.3	02 19	-10.1	26 14	-01.6	671	28	03.5	03 21	02.0	28 13	02.7	671	28	03.7	02 19	-12.4	26 14	-04.3
45001	48.0N	087.6W	667	28	00.4	04 01	-16.5	27 16	-06.5	661	28	01.6	01 19	00.1	12 06	00.5	668	28	-00.3	19 06	-16.7	27 16	-07.0
46001	56.3N	148.3W	665	28	06.3	06 22	-04.9	26 09	02.9	665	28	05.0	01 06	04.2	27 04	04.7	667	28	01.5	06 22	-09.2	26 09	-01.9
46002	42.5N	130.3W	669	28	12.7	23 21	07.2	20 02	10.4	669	28	11.2	18 22	10.3	13 11	10.6	669	28	02.0	23 21	-03.4	20 02	-00.1
46003	51.9N	155.7W	669	28	06.1	10 19	-04.7	27 20	03.1	669	28	04.7	16 03	04.3	08 14	04.5	670	28	01.8	10 19	-09.0	27 20	-01.4
46005	46.1N	131.0W	489	21	11.1	23 23	03.1	18 19	07.9	489	21	09.2	08 14	08.9	25 14	09.1	490	21	02.0	23 23	-06.0	18 19	-01.2
46006	40.8N	137.6W	628	27	14.1	23 06	09.1	01 20	12.0	628	27	12.3	01 04	11.3	07 23	11.8	629	27	02.3	23 11	-02.4	01 20	00.2
46011	34.9N	120.9W	668	28	18.0	26 10	09.6	09 15	13.1	668	28	15.2	26 21	12.9	13 00	13.6	668	28	04.3	26 10	-03.5	10 16	-00.4
46012	37.4N	122.7W	667	28	19.2	26 22	10.8	08 16	13.4	667	28	15.0	27 01	12.6	09 09	13.2	668	28	04.8	26 20	-01.9	08 16	00.2
46014	39.2N	124.0W	666	28	15.5	26 22	06.9	08 14	11.5	666	28	14.2	26 23	11.2	12 09	12.1	667	28	02.6	14 03	-04.6	08 14	-00.6
46016	63.3N	170.3W	192	28	00.7	12 09	-28.7	27 18	-13.7														
46022	40.8N	124.5W	666	28	15.8	14 22	07.5	07 11	11.4	666	28	12.8	27 00	10.5	07 16	11.5	667	28	04.7	14 22	-03.3	07 10	-00.2
46023	34.3N	120.7W	664	28	15.7	22 23	09.0	08 00	13.3	663	28	15.4	26 23	12.8	13 00	13.7	665	28	02.2	23 19	-04.4	08 00	-00.3
46025	33.6N	119.1W	667	28	23.9	24 02	09.4	08 04	14.4	667	28	17.8	24 21	14.2	01 12	15.0	667	28	07.9	24 02	-05.5	08 04	-00.6
46026	37.8N	122.7W	660	28	18.9	26 22	09.2	08 13	12.6	660	28	14.7	22 21	11.9	09 17	12.9	665	28	04.8	26 22	-03.1	08 13	-00.3
46027	41.8N	124.4W	667	28	17.6	26 20	06.7	07 15	10.5	667	28	12.9	27 01	09.8	09 14	10.9	669	28	05.6	26 20	-03.4	07 15	-00.4
46028	35.8N	121.9W	670	28	16.1	26 22	11.4	07 19	13.2	670	28	14.9	26 22	12.8	15 06	13.4	670	28	02.5	26 16	-01.9	07 19	-00.2
46029	46.2N	124.2W	649	28	13.6	26 23	00.3	19 15	07.4	648	28	11.0	27 00	07.4	12 16	09.7	661	28	02.7	26 23	-09.0	19 15	-02.3
46030	40.4N	124.5W	665	28	14.8	14 04	07.7	07 15	11.2	663	28	13.5	24 00	11.2	08 17	12.3	666	28	02.9	14 04	-04.3	07 15	-01.2
46035	57.0N	177.7W	668	28	04.3	14 21	-07.4	01 03	00.5	668	28	03.6	02 23	02.9	01 14	03.4	669	28	00.9	14 21	-10.4	01 03	-02.8
51001	23.4N	162.3W	670	28	23.8	22 03	17.4	25 11	21.7	670	28	23.7	10 04	21.7	26 16	22.6	670	28	01.4	22 03	-05.2	25 11	-01.0
51002	17.2N	157.8W	669	28	26.3	24 04	20.3	16 12	24.2	669	28	27.8	24 01	25.2	18 17	25.8	669	28	00.1	16 09	-05.2	16 12	-01.6
51003	19.2N	160.8W	669	28	25.6	09 01	20.5	23 04	23.8	669	28	26.5	28 02	24.5	17 18	25.2	669	28	00.7	22 19	-04.2	23 04	-01.4
51004	17.5N	152.5W	667	28	26.1	25 03	21.7	05 05	24.4	667	28	27.0	10 04	25.0	10 17	25.4	667	28	00.5	16 19	-03.9	05 05	-01.0
51005	20.3N	156.1W	664	28	25.8	07 02	20.6	16 09	23.4	664	28	26.7	28 22	23.5	05 18	24.3	668	28	00.7	06 19	-03.9	16 09	-01.0
ALRF1	24.9N	080.6W	664	28	27.1	09 21	12.0	26 12	21.8	663	28	24.8	19 20	20.3	01 10	22.9	665	28	03.7	09 21	-08.9	13 13	-01.1
ALSN6	40.5N	073.8W	669	28	08.2	02 20	-07.2	13 11	-00.3														
BURL1	28.9N	089.4W	649	28	20.7	21 20	03.2	12 15	15.6														
BUZM3	41.4N	071.0W	671	28	07.5	21 21	-08.8	26 12	-00.7														
CARO3	43.3N	124.4W	664	28	20.5	27 01	02.1	06 14	09.7														
CHLV2	36.9N	075.7W	670	28	17.7	05 21	-04.0	13 16	04.7	671	28	06.1	18 21	03.5	15 02	05.0	671	28	11.8	05 21	-08.7	13 16	-00.3
CLKN7	34.6N	076.5W	667	28	19.4	17 19	-01.9	13 14	09.8														
CSBF1	29.7N	085.4W	650	28	20.2	21 22	03.2	13 10	15.0														
DBLN6	42.6N	079.4W	646	28	10.7	18 20	-11.9	26 08	-04.0														
DESW1	47.7N	124.5W	665	28	13.8	27 18	-02.8	19 10	06.1														
DISW3	47.1N	090.7W	669	28	00.2	03 18	-17.9	21 11	-07.6														
DSLN7	35.2N	075.3W	696	28	21.6	18 13	-01.4	13 19	10.3														
FBIS1	32.7N	079.9W	667	28	19.3	11 20	-00.3	13 12	11.4														
FFIA2	57.3N	133.6W	654	28	11.5	27 14	-10.6	19 16	01.2														
FPSN7	33.5N	077.6W	414	19	20.5	06 00	03.7	25 16	14.5														
GDIL1	29.3N	089.9W	635	28	22.8	21 19	03.1	11 10	16.2	630	28	20.7	21 20	10.6	12 03	17.0	660	28	04.0	14 18	-12.4	11 10	-01.0
GLLN6	43.9N	076.4W	667	28	02.6	20 20	-17.2	06 13	-06.0														
IOSN3	42.9N	070.6W	670	28	03.9	22 21	-11.4	26 13	-02.5														
LKWF1	26.6N	080.0W	495	22	28.5	11 21	09.8	26 12	21.4	495	22	24.3	22 20	21.3	02 08	22.8	502	23	05.5	11 22	-12.1	26 09	-01.5
MDRM1	44.0N	068.1W	644	27	05.2	02 16	-10.5	04 14	-02.8														
MISM1	43.8N	068.9W	666	28	04.7	02 15	-10.8	07 09	-02.9														
NWPO3	44.6N	124.1W	665	28	17.8	26 22	00.2	09 14	08.0														
PILM4	48.2N	088.4W	660	28	00.0	04 01	-20.1	27 13	-07.9														
PTAC1	38.9N	123.7W	666	28	18.7	27 01	02.0	09 14	11.1														
PTAT2	27.8N	097.1W	664	28	23.4	05 21	01.8	11 15	14.9														
PTGC1	34.6N	120.7W	650	28	21.0	24 17	07.3	08 15	13.0														
SBIO1	41.7N	082.8W	640	28	06.7	05 02	-16.4	13 13	-03.4														
SGNW3	43.8N	087.7W	667	28	02.2	18 22	-17.5	10 14	-05.1	590	28	00.5	26 11	00.0	01 01	00.0	669	28	02.1	18 22	-17.5	10 14	-05.2
SISW1	48.3N	122.9W	666	28	13.2	24 20	-03.1	19 15	05.6														
SJLF1	30.4N	081.4W	667	28	27.2	05 19	01.3	12 13	14.8														
SPGF1	26.7N	079.0W	358	16	25.2	23 20	15.8	14 11	21.2														
SRST2	29.7N	094.1W	650	28	23.0	27 19	-00.8	12 06	13.4														
SVLS1	31.9N	080.7W	668	28	21.7	20 01	00.9	13 13	12.4	666	28	14.1	22 02	09.2	02 13	11.3	670	28	09.0	20 01	-09.6	13 13	01.1
TPLM2	38.9N	076.4W	196	09	10.6	21 23	-04.4	26 14	00.6	195	09	02.3	28 22	00.9	26 14	01.6	197	09	08.6	21 23	-05.9	26 11	-01.1
TTIW1	48.4N	124.7W	665	28	14.1	27 12	-01.1	19 15	05.8														
WPOW1	47.7N	122.4W	652	28	15.8	27 23	-01.9	19 16	05.8														

FEBRUARY 1986			WAVE HEIGHTS (METERS)				FREQUENCY OF WAVE HEIGHTS (%)							
BUOY	LAT	LONG	OBS	MAX	DY HR	MEAN	<1M	1-1.5M	2-2.5M	3-3.5M	4-5.5M	6-7.5M	8-9.5M	>9.5M
32301	10.0N	105.0W	188	2.5	21 03	1.9		31.3	68.6					
32302	18.0N	085.1W	669	3.0	07 16	1.9		29.5	69.2	1.1				
41004	32.6N	078.9W	669	4.5	27 06	1.2	15.6	69.8	10.6	2.9	0.8			
41006	29.3N	077.3W	668	5.5	26 02	1.7	0.4	65.8	22.3	10.1	1.1			
41007	34.2N	076.5W	696	4.5	27 11	1.4	5.0	75.4	15.0	3.8	0.5			
42001	25.9N	089.7W	664	2.5	04 11	1.2	10.2	73.6	16.1					
42002	26.0N	093.5W	655	3.0	28 09	1.2	20.0	65.8	12.8	1.3				
42003	26.0N	085.9W	662	2.5	12 02	1.0	28.3	61.7	9.8					
42007	30.1N	088.9W	118	1.5	28 23	0.6	71.9	28.0						
44004	38.5N	070.7W	667	5.0	07 22	2.3		29.9	40.4	23.9	5.5			
44005	42.7N	068.4W	655	5.0	22 12	1.9	2.2	47.0	34.6	13.7	2.2			
44007	43.5N	070.1W	603	3.0	02 13	0.9	55.8	32.0	11.9	0.1				
44008	40.5N	069.5W	344	3.5	19 14	2.0		39.5	38.0	22.3				
44011	41.1N	066.6W	561	6.5	22 18	2.4		29.5	38.8	21.2	9.6	0.7		
45001	48.0N	087.6W	233	1.5	01 19	0.7	56.2	43.7						
46001	56.3N	148.3W	658	7.0	08 14	3.4		5.0	25.0	32.2	34.9	2.7		
46002	42.5N	130.3W	668	8.5	01 04	3.7		4.0	15.4	35.3	36.2	7.4	1.4	
46003	51.9N	155.7W	665	7.5	05 20	3.9		3.6	19.3	27.2	36.8	12.9		
46004	50.9N	135.9W	659	10.0	27 20	3.6		2.7	22.3	34.9	34.1	5.1	0.6	0.1
46005	46.1N	131.0W	484	8.0	27 22	3.2		3.9	32.2	29.9	32.6	1.0	0.2	
46006	40.8N	137.6W	627	12.5	27 06	4.1			12.9	30.3	44.6	9.0	2.0	0.9
46011	34.9N	120.9W	664	8.0	01 15	3.1		6.4	32.9	35.2	20.7	4.3	0.1	
46012	37.4N	122.7W	658	7.0	01 11	3.1		10.0	34.8	28.7	23.8	2.5		
46014	39.2N	124.0W	665	7.5	03 14	3.4		4.8	29.1	34.1	25.1	6.7		
46022	40.8N	124.5W	662	7.0	01 09	3.3		2.8	33.5	32.9	26.1	4.5		
46023	34.3N	120.7W	653	6.5	01 15	2.9		6.7	40.5	34.7	15.9	1.9		
46025	33.6N	119.1W	666	6.5	16 04	2.0	2.4	41.5	38.8	11.2	5.1	0.7		
46026	37.8N	122.7W	637	6.5	01 11	2.8		16.0	36.8	26.8	20.0	0.1		
46027	41.8N	124.4W	665	6.5	03 11	3.0		4.5	39.8	30.9	23.1	1.5		
46028	35.8N	121.9W	667	7.5	01 19	3.3		4.1	28.9	36.7	26.3	3.7		
46029	46.2N	124.2W	494	5.0	28 09	2.4	1.0	19.4	45.9	21.6	11.9			
46035	57.0N	177.7W	666	8.5	06 09	2.7	2.2	16.6	45.4	20.4	11.2	2.8	1.0	
51001	23.4N	162.3W	666	9.5	23 07	3.5		5.5	32.5	28.3	21.3	9.9	2.2	
51002	17.2N	157.8W	668	5.5	23 22	2.5		11.2	56.7	22.1	9.8			
51003	19.2N	160.8W	668	7.0	23 16	2.9		7.3	48.8	23.8	18.7	1.3		
51004	17.5N	152.5W	666	7.5	14 09	2.8		3.6	54.8	25.0	14.7	1.8		
51005	20.3N	156.1W	664	2.5	16 02	1.4	0.6	83.5	15.6					
PTGC1	34.6N	120.7W	123	0.0	00 00	0.0								20.3

BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	MAX DY HR	DIR	N	NE	E	SE	S	SW	W	NW	TOTAL
FEBRUARY 1986			PRESSURE (MB)							WIND SPEEDS (KNOTS)			MEAN WIND SPEED (KNOTS)								
32301	10.0N	105.0W	189	08	1013.3	21 16	1009.4	22 23	1011.4	189	07 26 06	100			5.0	4.8					04.9
32302	18.0N	085.1W	671	28	1017.9	17 04	1009.4	22 22	1013.8	671	17 01 07	140		10.0	9.5	10.3	7.0				09.9
41001	34.9N	072.9W	670	28	1035.1	01 16	991.8	27 20	1014.8	670	30 15 07	190	11.1	8.7	9.1	10.3	14.6	14.6	14.6	15.0	13.9
41004	32.6N	078.9W	673	28	1029.4	14 06	999.6	27 16	1015.9	653	31 15 06	230	11.8	7.2	5.2	8.1	12.4	15.3	12.4	11.8	12.1
41006	29.3N	077.3W	668	28	1032.1	01 16	1005.5	25 10	1017.3	662	27 15 12	250	9.3	6.4	7.7	7.9	10.8	15.0	14.4	13.5	11.8
41007	34.2N	076.5W	697	28	1035.5	01 16	995.2	27 17	1016.3	176	25 07 08	240	4.1	6.0	2.8	8.4	13.0	14.8	12.3	3.9	11.0
42001	25.9N	089.7W	670	28	1027.9	13 16	1008.4	27 22	1015.4	667	26 04 08	150	13.7	10.2	12.8	14.7	14.2	12.7	10.6	13.8	13.5
42002	26.0N	093.5W	670	28	1027.4	12 17	1006.7	08 23	1015.2	670	32 28 08	020	18.3	16.5	12.5	14.4	14.5	13.3	5.9	9.4	14.4
42003	26.0N	085.9W	668	28	1028.1	13 16	1009.4	27 21	1017.0	664	28 25 11	340	16.6	13.0	12.9	10.3	12.2	13.5	10.0	14.8	12.9
42007	30.1N	088.9W	222	10	1020.4	25 17	1004.0	27 10	1013.0	216	23 28 23	350	11.9	12.7	6.8	3.9	9.2	10.1	9.0	10.0	10.2
44004	38.5N	070.7W	671	28	1036.9	01 16	990.8	27 21	1014.0	669	29 02 17	240	14.7	16.2	15.4	16.7	12.9	17.4	17.8	17.9	16.7
44005	42.7N	068.4W	664	28	1036.8	01 16	991.0	26 18	1013.2	663	28 22 11	350	13.5	11.4	11.7	13.5	13.5	14.0	13.3	13.4	13.1
44007	43.5N	070.1W	658	28	1038.7	01 15	992.7	26 19	1015.3	620	33 06 12	340	12.8	12.8	8.9	9.3	9.8	8.7	10.0	10.8	10.9
44008	40.5N	069.5W	345	15	1026.0	17 07	995.7	27 23	1010.6	329	31 22 13	350	15.6	9.9	11.2	11.8	12.3	12.0	14.5	16.6	13.9
44011	41.1N	066.6W	562	24	1036.2	01 23	996.4	19 09	1014.2	560	31 22 17	310	14.6	15.2	12.9	14.1	13.4	13.0	15.1	16.4	15.1
44012	38.8N	074.6W	654	28	1036.8	01 15	997.7	27 19	1016.4	633	33 07 06	060	11.1	13.9	11.5	6.0	11.3	11.1	10.4	14.3	12.4
44013	42.4N	070.8W	671	28	1038.6	01 15	994.8	26 20	1014.8	644	25 26 02	310	12.4	11.3	8.5	9.6	8.6	9.9	13.3	13.6	12.3
45001	48.0N	087.6W	667	28	1030.0	21 12	1002.3	18 10	1016.8												
46001	56.3N	148.3W	666	28	1020.8	11 11	963.6	01 17	1003.4	661	34 08 13	200	10.4	12.7	16.0	16.8	13.4	16.3	15.3	11.5	14.7
46002	42.5N	130.3W	669	28	1025.9	05 20	978.6	15 03	1009.5	660	32 02 22	260	12.5	11.5	12.5	12.5	13.7	13.6	14.8	13.3	13.2
46003	51.9N	155.7W	669	28	1013.0	17 07	976.6	06 03	996.3	665	34 05 14	100	13.7	18.6	18.7	18.2	17.1	16.6	14.6	13.1	16.6
46004	50.9N	135.9W	029	02	998.5	02 06	971.9	01 03	980.7												
46005	46.1N	131.0W	489	21	1027.6	08 19	981.7	15 12	1008.5	489	25 21 16	130	9.0	12.2	16.7	12.8	14.8	15.3	8.3	10.1	13.2
46006	40.8N	137.6W	628	27	1025.4	04 20	972.9	14 02	1006.1	625	43 02 08	290	8.5	10.5	15.2	15.3	15.1	14.8	14.1	14.7	14.8
46011	34.9N	120.9W	668	28	1026.6	21 18	1004.2	14 22	1017.8	661	37 14 21	150	10.5	8.0	5.4	15.9	14.2	6.2	5.7	13.5	12.1
46012	37.4N	122.7W	667	28	1027.7	22 19	995.8	14 21	1016.3	667	41 14 21	150	10.2	8.5	4.6	18.8	16.9	11.5	9.4	13.7	14.3
46014	39.2N	124.0W	664	28	1027.9	22 19	989.7	14 23	1015.2	650	39 14 21	140	9.0	5.3	5.5	16.6	15.0	10.5	6.8	12.5	12.7
46016	63.3N	170.3W	191	28	1025.0	19 21	983.3	01 03	1011.3												
46017	60.3N	172.3W	208	28	1020.8	20 06	979.5	07 03	1006.2	214	30 06 06	050	14.4	16.0	12.3	16.9	15.6	11.2	4.6	5.9	14.9
46022	40.8N	124.5W	666	28	1026.8	04 19	985.7	15 00	1013.6	648	36 15 01	180	9.5	6.3	4.2	9.9	17.9	13.4	8.8	9.9	13.1
46023	34.3N	120.7W	664	28	1025.3	03 07	1006.7	14 23	1018.0	662	29 14 21	130	14.2	6.9	14.2	14.8	9.1	5.8	6.5	15.8	13.2
46025	33.6N	119.1W	667	28	1024.8	02 18	1008.2	08 14	1017.2	648	27 04 05	280	8.5	11.0	12.6	10.3	7.6	5.9	10.6	10.6	09.8
46026	37.8N	122.7W	661	28	1029.0	22 19	996.5	14 22	1017.1	653	38 14 21	150	4.2	6.7	8.1	17.7	16.7	10.6	10.2	11.6	12.5
46027	41.8N	124.4W	668	28	1027.6	04 19	987.3	15 02	1013.9	641	41 15 02	180	7.7	3.6	5.3	12.7	18.0	11.0	7.4	8.4	12.2
46028	35.8N	121.9W	670	28	1027.6	21 18	1002.6	14 21	1016.0	665	35 14 21	150	8.6	4.5	8.0	17.2	12.3	8.2	5.5	12.3	11.8
46029	46.2N	124.2W	650	28	1029.1	06 19	980.6	15 22	1011.8	637	25 01 13	200	6.6	8.7	12.5	9.0	16.7	12.9	10.1	6.7	12.0
46030	40.4N	124.5W	665	28	1027.1	04 19	986.9	14 23	1014.2	625	39 02 05	130	10.9	5.0	4.6	19.7	14.7	10.3	6.6	10.4	14.4
46035	57.0N	177.7W	668	28	1019.7	25 00	964.8	07 15	1000.7	667	32 06 07	030	15.7	17.3	15.7	15.3	14.0	14.4	9.4	11.1	15.9
51001	23.4N	162.3W	670	28	1019.7	01 21	1003.9	22 03	1013.1	666	29 04 15	300	9.7	6.3	6.4	7.7	8.5	11.3	13.3	15.2	11.9
51002	17.2N	157.8W	669	28	1018.8	01 20	1009.5	12 02	1014.0	655	21 16 12	320	7.8	7.4	10.5	8.8	7.0	8.5	8.0	9.8	09.0
51003	19.2N	160.8W	669	28	1019.5	01 20	1008.8	15 15	1014.3	528	24 16 14	300	7.4	5.3	5.9	6.7	9.0	12.0	8.2	11.2	08.4
51004	17.5N	152.5W	667	28	1018.2	02 20	1006.9	13 02	1013.1	660	24 16 20	280	5.2	7.7	10.2	7.2	7.8	12.7	13.5	7.9	09.3
51005	20.3N	156.1W	663	28	1018.1	01 21	1005.3	16 02	1012.6	664	23 12 23	260	5.7	10.8	7.3	2.8	11.9	11.2	12.4	1.6	10.2
ALRF1	24.9N	080.6W	664	28	1027.0	01 15	1010.9	28 21	1017.7	642	30 26 02	300	12.2	11.2	14.2	12.1	10.3	9.1	9.2	12.2	11.4
ALSN6	40.5N	073.8W	669	28	1037.7	01 16	999.6	27 21	1016.6	633	31 26 02	350	14.8	12.1	13.8	11.0	8.6	10.0	8.4	14.3	12.9
BURL1	28.9N	089.4W	665	28	1031.3	13 14	1006.7	27 09	1016.7	639	34 08 07	090	13.1	10.9	12.3	16.3	13.0	13.4	11.1	16.5	13.7
BUZM3	41.4N	071.0W	671	28	1038.3	01 15	997.6	27 23	1015.3	637	31 26 04	320	12.8	11.9	12.8	18.6	13.0	13.9	14.7	13.7	13.7
CARO3	43.3N	124.4W	666	28	1027.8	06 17	986.3	15 10	1012.8	642	33 23 12	190	11.5	8.7	5.0	5.2	16.3	16.2	12.8	4.2	12.1
CHLV2	36.9N	075.7W	671	28	1036.0	01 15	995.7	27 18	1015.9	626	32 11 15	010	15.1	13.5	12.9	8.7	16.6	14.2	8.6	15.3	14.2
CLKN7	34.6N	076.5W	667	28	1035.6	01 16	995.2	27 18	1016.0	622	27 15 07	250	10.8	9.6	7.0	2.6	8.5	11.5	10.5	8.9	10.1
CSBF1	29.7N	085.4W	664	28	1030.2	13 14	1004.4	27 06	1015.9	634	24 18 04	200	4.7	2.7	3.9	5.2	7.6	7.1	10.2	5.9	05.8
DBLN6	42.6N	079.4W	649	28	1033.2	01 07	1002.0	05 04	1016.2	641	28 07 04	060	7.1	9.4	5.2	3.8	4.1	11.7	10.6	5.9	08.7
DESW1	47.7N	124.5W	666	28	1030.4	06 18	977.1	15 22	1011.4	660	38 24 22	160	4.7	6.5	6.5	16.8	17.5	8.9	9.7	8.1	11.4
DISW3	47.1N	090.7W	669	28	1029.9	21 12	1000.3	26 12	1017.5	661	30 26 20	020	10.0	10.7	7.4	3.9	4.1	12.8	9.9	11.2	09.6
DSLN7	35.2N	075.3W	697	28	1036.8	01 16	995.6	27 20	1016.1	612	39 25 13	350	17.5	11.1	10.6	10.6	19.7	20.0	14.7	13.5	16.0
FBIS1	32.7N	079.9W	666	28	1033.5	01 15	998.8	27 14	1016.1	655	25 25 15	030	8.7	5.1	4.9	4.1	5.0	8.2	5.1	4.5	06.1
FFIA2	57.3N	133.6W	664	28	1032.3	06 21	982.2	24 01	1011.8	576	37 02 02	150	14.1	10.0	3.9	17.3	9.5	5.9	1.5	9.2	12.2
FPSN7	33.5N	077.6W	414	19	1034.3	01 16	997.0	27 18	1015.3	393	36 27 17	240	13.7	10.1	5.0	6.4	14.4	17.7	13.7	13.3	13.8
GDIL1	29.3N	089.9W	656	28	1031.4	13 14	1006.2	27 08	1016.0	632	28 28 21	340	15.6	10.7	8.7	9.2	7.7	9.8	9.7	13.5	10.3
GLLN6	43.9N	076.4W	665	28	1036.1	01 13	1003.2	27 04	1015.8	626	32 13 22	270	7.9	7.3	7.0	10.7	17.3	14.4	15.8	10.8	10.2
IOSN3	42.9N	070.6W	669	28	1037.4	01 15	993.6	26 20	1014.3	606	31 06 12	300	14.3	10.9	9.8	13.3	9.7	11.9	15.0	14.0	13.7
LKWF1	26.6N	080.0W	494	22	1028.8	01 16	1008.6	27 20	1016.4	492	19 02 02	080	10.5	7.7	10.8	9.5	12.3	6.9	6.0	7.7	09.2
MDRM1	44.0N	068.1W	644	27	1036.8	01 15	989.3	26 19	1013.8	613	40 22 09	010	17.9	14.9	16.5	19.7	15.3	13.0	15.4	18.6	17.2
MISM1	43.8N	068.9W	666	28	1037.3	01 15	990.5	26 20	1014.1	638	35 22 14	340	15.1	14.0	15.0	16.3	10.9	12.2	15.7	16.6	15.4
NWPO3	44.6N	124.1W	663	28	1028.3	06 19	985.0	15 11	1012.5	654	30 23 19	190	7.0	4.8	8.4	6.1	16.2	14.8	9.1	7.0	10.4
PILM4	48.2N	088.4W	660	28	1029.8	21 11	1002.7	18 09	1017.0	622	30 13 05	260	7.0	12.8	11.2	13.7	11.8	11.9	13.2	10.1	11.1
PTAC1	38.9N	123.7W	667	28	1028.1	22 18	990.4	14 21	1015.3	599	46 14 22	160	10.3	3.3	5.4	13.6	16.2	9.8	4.2	11.0	12.0
PTAT2	27.8N	097.1W	665	28	1030.1	12 16	1004.3	27 10	1015.3	614	24 08 14	010	14.0	12.6	9.0	10.0	10.1	5.7	5.3	11.4	10.6
PTGC1	34.6N	120.7W	649	28	1025.3	21 16	1004.0	14 22	1017.4	573	37 04 04	330	14.1	6.6	4.5	17.9	7.7	4.4	3.5	17.4	13.4
SBIO1	41.7N	082.8W	635	28	1030.1	01 01	998.0	26 21	1016.2	631	23 07 00	070	7.0	5.5	8.5	7.3	4.9	10.7	11.8	9.9	08.8
SGNW3	43.8N	087.7W	666	28	1027.5	01 01	997.1	26 18	1016.6	634	28 21 01	010	13.9	15.9	12.6	8.3	9.3	6.6	9.6	8.6	10.6
SISW1	48.3N	122.9W	666	28	1030.7	06 19	977.1	16 01	1012.3	643	34 04 23	160	6.9	8.6	7.2	11.1	13.5	5.9	11.2	7.6	09.3
SJLF1	30.4N	081.4W	667	28	1031.8	01 15	1032.9	27 19	1017.2	657	20 08 15	020	5.9	6.9	5.5	6.6	7.8	7.9	7.0	8.5	07.3
SPGF1	26.7N	079.0W	358	16	1025.7	14 03	1008.9	25 08	1015.6	350	24 25 09	310	10.4	5.2	7.6	4.3	3.1	4.4	2.6	11.1	06.5
SRST2	29.7N	094.1W	657	28	1032.3	12 15	1005.8	05 23	1016.3	621	22 04 04	160	8.5	8.1	10.2	10.5	8.6	9.6	8.9	8.1	09.2
STDM4	47.2N	087.2W								637	31 20 12	350	13.5	10.6	14.3	14.2	14.7	8.9	16.2	14.8	14.2
SVLS1	31.9N	080.7W	668	28	1032.4	01 16	1000.4	27 19	1016.5	658	40 06 18	270	10.7	8.3	6.9	7.6	14.4	13.4	11.1	13.1	12.0
TPLM2	38.9N	076.4W	196	09	1019.7	22 14	997.2	27 09	1011.2	182	26 22 00	330	8.5	4.2	7.0	10.7	10.6	5.0	7.5	10.2	08.9
TTIW1	48.4N	124.7W	666	28	1031.2	06 18	975.3	15 22	1012.1	665	38 13 11	060	3.2	14.0	17.0	11.9	22.0	12.6	12.4	8.1	15.8
WPOW1	47.7N	122.4W	654	28	1030.5	06 18	978.6	15 23	1012.6	619	27 16 05	200	8.2	4.1	2.7	4.5	12.8	9.6	3.8	3.4	07.8

BUOY	LAT	LONG	CALM	<4KT	4-10KT	11-21KT	22-33KT	34-47KT	>47KT	N	NE	E	SE	S	SW	W	NW
FEBRUARY 1986			TOTAL FREQUENCY OF WIND SPEEDS (%)							TOTAL FREQUENCY OF WIND DIRECTIONS (%)							
32301	10.0N	105.0W		5.3	94.7							39.3	60.7				
32302	18.0N	085.1W		0.4	65.0	34.6					<.05	34.5	63.7	1.8			
41001	34.9N	072.9W		4.9	27.3	59.4	8.4			10.7	6.0	5.0	6.9	15.6	15.7	14.0	26.1
41004	32.6N	078.9W	2.0	6.6	39.1	47.3	7.0			11.3	8.5	3.7	4.9	13.2	25.4	21.2	11.7
41006	29.3N	077.3W		7.3	34.4	51.5	6.8			6.3	4.1	9.0	12.0	14.5	26.1	10.0	17.9
41007	34.2N	076.5W	4.5	10.2	34.1	52.8	2.8			6.3	14.2	5.4	3.1	8.4	35.7	24.0	3.0
42001	25.9N	089.7W		1.8	23.2	71.2	3.7			15.8	5.5	10.9	15.1	20.8	15.1	2.7	6.0
42002	26.0N	093.5W		1.5	26.7	58.2	13.6			11.5	9.9	9.3	19.0	27.0	17.4	1.2	4.8
42003	26.0N	085.9W		4.4	27.9	64.5	3.3			13.9	8.7	14.5	18.2	22.0	14.0	3.4	5.3
42007	30.1N	088.9W		6.5	47.7	45.4	0.5			16.4	17.0	1.7	4.3	15.2	26.4	14.1	4.9
44004	38.5N	070.7W		0.6	16.0	59.5	23.9			17.5	16.9	5.4	1.3	3.5	9.5	16.7	29.1
44005	42.7N	068.4W		3.5	25.8	66.7	4.1			16.0	10.3	8.1	7.3	2.8	5.0	13.7	36.8
44007	43.5N	070.1W	3.2	4.5	47.9	43.7	3.9			22.3	8.6	3.4	3.3	6.1	7.7	18.3	30.2
44008	40.5N	069.5W	1.8	4.0	28.9	51.1	16.1			15.8	13.5	11.9	5.0	2.7	3.0	20.9	27.1
44011	41.1N	066.6W		2.7	17.1	66.1	14.1			15.7	14.3	6.9	3.9	4.2	3.7	20.3	31.0
44012	38.8N	074.6W	6.0	5.1	39.7	47.6	7.7			17.3	25.6	7.1	3.3	13.2	4.1	5.3	24.2
44013	42.4N	070.8W	1.2	3.7	35.1	58.9	2.3			15.1	6.2	4.5	6.6	2.3	8.9	25.9	30.5
46001	56.3N	148.3W		4.5	22.1	60.8	12.4	0.2		9.2	14.2	27.7	15.2	6.8	10.7	11.4	4.8
46002	42.5N	130.3W		5.3	28.2	60.0	6.5			3.6	10.0	13.7	15.4	14.1	28.6	10.1	4.4
46003	51.9N	155.7W		2.0	13.1	61.4	23.3	0.3		8.1	10.2	28.0	13.5	9.9	4.0	8.9	17.3
46005	46.1N	131.0W		4.1	30.7	58.7	6.5			16.2	11.0	18.3	10.8	20.1	12.4	4.6	6.5
46006	40.8N	137.6W		3.8	29.1	46.4	19.4	1.3		1.9	1.4	9.1	16.2	31.2	24.8	11.0	4.3
46011	34.9N	120.9W		6.2	39.0	45.4	8.9	0.5		18.3	5.7	1.1	18.8	16.4	7.5	5.6	26.6
46012	37.4N	122.7W		2.4	31.5	49.8	15.4	0.9		13.8	1.5	8.3	15.5	23.5	11.5	3.0	30.9
46014	39.2N	124.0W		7.2	33.2	50.2	8.9	0.5		15.6	1.8	7.2	27.4	20.7	10.2	1.2	15.9
46017	60.3N	172.3W		6.5	17.3	55.6	20.6			20.7	32.4	12.6	22.5	6.3	2.5	2.0	1.1
46022	40.8N	124.5W		10.0	27.5	48.6	13.1	0.8		14.4	3.9	3.7	14.4	39.0	15.3	3.3	6.0
46023	34.3N	120.7W		6.6	30.2	53.2	10.0			10.6	1.3	7.1	15.1	10.5	6.6	6.9	41.8
46025	33.6N	119.1W		11.9	50.0	34.9	3.2			7.3	3.2	6.9	15.2	9.1	10.6	22.8	24.9
46026	37.8N	122.7W		7.4	38.6	42.1	11.2	0.8		2.7	6.4	3.8	10.2	24.5	15.5	9.5	27.4
46027	41.8N	124.4W	12.5	9.5	39.3	35.1	14.8	1.2		9.6	7.9	7.3	20.8	34.5	11.8	2.6	5.6
46028	35.8N	121.9W		7.1	42.1	42.4	8.3	0.2		11.5	0.5	0.2	13.2	18.6	8.8	4.9	42.1
46029	46.2N	124.2W	2.8	4.7	39.4	51.0	4.9			7.8	11.5	31.7	4.3	22.9	10.9	6.3	4.5
46030	40.4N	124.5W	3.0	7.4	26.9	49.1	15.7	1.0		15.0	6.9	1.6	34.0	28.9	6.1	1.1	6.5
46035	57.0N	177.7W		0.6	13.6	73.5	12.3			9.3	33.1	23.7	22.2	4.3	5.0	1.1	1.2

FEBRUARY 1986			TOTAL FREQUENCY OF WIND SPEEDS (%)							TOTAL FREQUENCY OF WIND DIRECTIONS (%)							
BUOY	LAT	LONG	CALM	<4KT	4-10KT	11-21KT	22-33KT	34-47KT	>47KT	N	NE	E	SE	S	SW	W	NW
51001	23.4N	162.3W		5.3	39.6	46.8	8.3			7.5	2.8	1.2	1.6	13.3	29.9	19.2	24.6
51002	17.2N	157.8W		9.8	56.3	33.9				15.5	12.5	37.5	8.7	5.0	8.3	7.4	5.1
51003	19.2N	160.8W		14.2	55.1	29.7	0.9			9.4	8.4	18.7	7.9	7.9	10.2	17.7	19.8
51004	17.5N	152.5W		10.0	51.4	38.3	0.3			3.1	19.5	38.8	11.1	12.5	11.6	2.3	1.1
51005	20.3N	156.1W	7.2	8.9	43.4	46.4	1.4			0.5	24.5	15.6	4.6	11.3	27.3	14.5	1.7
ALRF1	24.9N	080.6W	3.0	8.9	35.4	51.4	4.4			9.3	5.8	14.6	20.9	15.2	11.8	12.8	9.5
ALSN6	40.5N	073.8W	2.1	8.1	27.3	55.8	8.8			16.8	19.7	21.7	4.9	2.0	4.3	7.9	22.6
BURL1	28.9N	089.4W	1.1	2.3	22.7	68.4	6.4	0.2		13.7	8.3	12.9	17.1	17.5	12.4	6.0	12.0
BUZM3	41.4N	071.0W	1.3	4.1	28.9	54.5	12.6			16.6	12.7	5.5	2.8	1.5	8.0	26.4	26.5
CARO3	43.3N	124.4W	1.9	8.7	39.7	37.9	13.7			6.7	14.9	7.8	13.6	37.4	14.6	3.1	1.9
CHLV2	36.9N	075.7W	1.1	3.4	27.2	57.0	12.5			25.2	17.4	4.8	5.1	12.9	8.9	5.1	20.6
CLKN7	34.6N	076.5W	2.9	8.0	42.6	47.6	1.8			24.6	23.3	0.5	2.1	11.7	23.6	7.1	7.0
CSBF1	29.7N	085.4W	4.6	29.3	57.1	13.4	0.2			9.7	13.1	14.2	12.7	17.0	12.9	9.0	11.5
DBLN6	42.6N	079.4W	5.1	21.5	45.1	28.7	4.7			5.9	23.8	6.3	3.7	11.7	25.4	15.7	7.4
DESW1	47.7N	124.5W	2.1	15.0	40.0	30.8	13.8	0.5		3.8	19.5	11.8	25.3	16.6	6.0	8.0	8.9
DISW3	47.1N	090.7W	5.0	18.0	41.8	34.6	5.6			7.2	13.4	17.5	6.4	8.8	26.1	9.3	11.3
DSLN7	35.2N	075.3W	1.1	5.2	16.5	43.6	31.5	1.1		34.7	5.2	1.3	1.8	8.1	22.8	9.9	16.1
FBIS1	32.7N	079.9W	5.2	27.2	60.5	12.1	0.3			7.1	10.3	9.8	6.3	9.2	31.1	14.2	11.9
FFIA2	57.3N	133.6W	10.6	15.6	30.4	36.3	17.2	0.5		30.7	17.8	7.3	23.0	14.3	2.8	1.0	3.2
FPSN7	33.5N	077.6W	1.0	4.6	27.5	56.7	10.7	0.5		11.9	16.2	3.4	3.8	9.9	29.7	16.3	8.8
GDIL1	29.3N	089.9W	0.5	4.6	51.4	42.2	1.7			11.2	12.0	15.3	16.8	13.9	14.5	10.2	7.0
GLLN6	43.9N	076.4W	2.9	9.7	52.1	32.3	5.9			11.1	30.7	12.9	3.3	4.4	4.9	15.4	17.3
IOSN3	42.9N	070.6W	0.7	3.8	26.6	60.7	8.9			14.8	7.5	3.5	4.5	3.6	6.6	33.3	26.2
LKWF1	26.6N	080.0W	0.8	7.3	53.9	38.8				2.4	2.1	14.6	9.9	24.8	20.6	11.5	14.2
MDRM1	44.0N	068.1W	1.0	3.4	13.9	56.6	24.5	1.6		16.5	11.6	8.7	3.8	4.5	3.1	13.4	38.3
MISM1	43.8N	068.9W		3.3	22.1	58.2	15.7	0.8		13.0	10.9	7.1	5.7	2.2	8.0	17.0	36.1
NWPO3	44.6N	124.1W	2.6	10.4	49.4	31.3	8.9			5.2	8.7	33.6	5.1	23.1	11.7	5.2	7.5
PILM4	48.2N	088.4W	1.8	7.2	43.6	43.7	5.5			18.7	9.1	14.7	9.2	4.7	7.8	19.2	16.6
PTAC1	38.9N	123.7W	2.5	8.0	40.9	40.4	10.0	0.7		18.1	2.7	8.8	22.0	30.3	9.5	2.8	5.9
PTAT2	27.8N	097.1W	1.1	3.7	49.2	46.1	1.0			15.9	8.9	10.6	23.5	23.2	4.3	3.7	9.8
PTGC1	34.6N	120.7W	5.9	12.9	30.9	34.4	18.7	2.4		31.8	3.5	1.1	23.3	20.2	1.3	2.1	15.9
SBIO1	41.7N	082.8W	4.1	17.6	45.0	36.1	1.3			11.1	13.0	22.0	7.3	3.6	11.8	18.6	12.4
SGNW3	43.8N	087.7W	4.1	12.5	40.2	41.6	5.7			10.7	14.0	10.1	6.1	7.7	10.6	20.0	20.8
SISW1	48.3N	122.9W	4.0	17.1	46.8	30.5	5.4	0.2		11.2	17.5	15.1	17.8	13.6	5.6	9.4	9.8
SJLF1	30.4N	081.4W	2.4	14.6	66.2	19.2				9.2	10.2	5.7	7.4	16.7	18.9	18.9	12.9
SPGF1	26.7N	079.0W	10.6	35.7	42.0	19.4	2.9			5.3	10.0	12.0	4.9	14.4	26.0	4.6	22.8
SRST2	29.7N	094.1W	1.6	6.8	56.2	36.9	0.2			15.4	10.2	9.5	16.9	16.7	17.4	5.9	7.9
STDM4	47.2N	087.2W	2.0	7.4	24.2	54.6	13.8			16.5	7.5	7.8	12.3	14.4	3.6	21.4	16.4
SVLS1	31.9N	080.7W	3.8	13.2	26.7	53.5	6.4	0.2		5.8	6.6	6.2	7.2	26.0	19.8	13.1	15.3
TPLM2	38.9N	076.4W	6.0	11.0	46.7	40.7	1.6			19.4	9.9	3.8	5.4	6.6	0.1	12.4	42.4
TTIW1	48.4N	124.7W	1.8	7.2	31.0	32.0	24.1	5.7		2.1	12.0	44.1	7.1	16.5	3.5	9.3	5.5
WPOW1	47.7N	122.4W	9.2	25.5	44.9	26.3	3.2			15.9	29.9	3.4	10.7	31.8	5.8	0.9	1.6

B U O Y   C L I M A T O L O G I C A L   D A T A   S U M M A R Y

MARCH 1986			AIR TEMPERATURE (DEG C)							SEA TEMPERATURE (DEG C)							AIR-SEA TEMPERATURE DIFFERENCE (DEG C)						
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN
32301	10.0N	105.0W								729	31	26.7	29 23	25.8	01 02	26.2							
32302	18.0N	085.1W								732	31	23.7	21 20	22.9	01 02	23.3							
41001	34.9N	072.9W								636	27	23.9	03 23	20.4	27 10	22.1							
41002	32.3N	075.3W								126	06	22.3	31 22	20.9	26 18	21.6							
41004	32.6N	078.9W								292	12	19.0	01 04	17.1	01 22	17.8							
41006	29.3N	077.3W								740	31	23.9	31 19	21.3	02 15	22.7							
41007	34.2N	076.5W	002	01	00.2	08 16	-00.2	08 15	-00.[illegible]	768	31	21.9	31 05	13.6	07 04	17.1	585	24	-14.5	23 01	-22.1	31 05	-17.6
42001	25.9N	089.7W								740	31	25.1	14 21	21.9	27 12	23.5							
42002	26.0N	093.5W								739	31	25.3	07 21	21.1	01 14	22.6							
42003	26.0N	085.9W								740	31	25.6	19 21	20.8	02 02	23.0							
42007	30.1N	088.9W								480	21	18.7	14 21	13.0	04 14	15.9							
44004	38.5N	070.7W	015	01	00.5	08 20	-02.5	08 07	-01.7	740	31	17.9	31 20	12.1	22 23	13.1	571	24	-12.6	22 23	-18.4	31 20	-13.5
44005	42.7N	068.3W	094	06	00.2	07 19	-08.9	21 14	-03.7														
44007	43.5N	070.1W	190	16	00.2	01 15	-12.3	21 10	-04.0														
44008	40.5N	069.5W	071	05	00.4	22 16	-07.9	08 13	-03.4														
44009	38.5N	074.6W	056	05	00.2	22 05	-07.8	08 12	-03.9														
44012	38.8N	074.6W	093	07	00.1	02 08	-07.8	08 11	-02.8														
44013	42.4N	070.8W	158	12	00.1	03 09	-13.1	08 11	-04.1														
46001	56.3N	148.3W	075	05	00.1	02 14	-04.3	01 05	-01.5														
46002	42.5N	130.3W								741	31	11.9	04 01	10.0	24 06	10.7							
46003	51.9N	155.9W	046	04	00.1	02 13	-02.5	01 04	-01.1														
46010	46.2N	124.2W								116	06	12.0	29 01	10.5	26 10	10.9							
46011	34.9N	120.9W								732	31	15.8	19 23	12.9	26 07	13.8							
46012	37.4N	122.7W								734	31	15.0	28 01	13.0	19 16	13.8							
46014	39.2N	124.0W								737	31	13.3	06 23	11.2	31 15	12.4							
46016	63.3N	170.3W	248	31	05.6	01 18	-24.8	31 12	-15.8														
46022	40.8N	124.5W								735	31	13.4	25 22	11.4	12 03	12.0							
46023	34.3N	120.7W								733	31	15.9	19 23	12.1	26 10	13.5							
46025	33.6N	119.1W								738	31	18.3	26 01	13.8	15 11	15.4							
46026	37.8N	122.7W								730	31	15.8	27 23	11.4	19 10	13.5							
46027	41.8N	124.4W								735	31	13.2	27 00	10.5	31 14	11.5							
46028	35.8N	121.9W								738	31	15.0	20 00	12.1	25 14	13.5							
46029	46.2N	124.2W								488	22	11.7	01 23	10.1	02 05	10.9							
46030	40.4N	124.5W								623	28	14.6	26 23	11.2	31 05	12.5							
46035	57.0N	177.7W	333	19	00.1	01 09	-06.2	09 11	-02.5														
51001	23.4N	162.3W								040	02	22.7	01 01	22.3	01 18	22.5							
51002	17.2N	157.8W								740	31	26.2	02 02	25.6	19 15	26.0							
51003	19.2N	160.8W								739	31	27.1	01 02	24.6	28 01	25.5							
51004	17.5N	152.6W								738	31	26.4	05 02	25.1	27 18	25.5							
51005	20.3N	156.1W								733	31	26.0	18 05	23.0	20 23	24.5							
ALRF1	24.9N	080.6W								738	31	25.9	20 22	17.9	02 13	22.9							
ALSN6	40.5N	073.8W	123	08	00.2	03 12	-09.7	08 10	-03.4														
BUZM3	41.4N	071.0W	118	09	00.1	02 07	-12.4	08 11	-03.9														
CHLV2	36.9N	075.7W	048	06	00.1	01 17	-05.9	08 13	-02.4	012	03	11.1	31 20	10.0	27 19	10.3	101	05	-10.1	27 21	-11.2	31 20	-10.1
CLKN7	34.6N	076.5W	010	01	00.2	08 17	-02.5	08 12	-01.5														
DBLN6	42.6N	079.4W	237	17	00.1	05 11	-13.9	08 09	-05.4														
DISW3	47.1N	090.7W	384	23	00.1	02 08	-19.9	07 14	-05.6														
DSLN7	35.2N	075.3W	017	01	00.2	08 23	-03.0	08 12	-01.9														
FFIA2	57.3N	133.6W	013	01	00.1	06 19	-01.0	06 12	-00.6														
GDIL1	29.3N	089.9W								728	31	22.4	31 23	11.2	22 13	18.3							
GLLN6	43.9N	076.4W	287	20	00.1	02 16	-14.3	08 04	-04.5														
IOSN3	42.9N	070.6W	185	15	00.1	02 05	-13.5	08 10	-04.2														
LKWF1	26.6N	080.0W								740	31	24.6	27 21	19.3	23 12	22.6							
MDRM1	44.0N	068.1W	206	15	00.1	01 18	-13.7	21 12	-04.2														
MISM1	43.8N	068.9W	207	13	00.1	02 18	-13.4	21 12	-04.1														
PILM4	48.2N	088.4W	496	27	00.1	17 05	-22.1	07 15	-05.3														
ROAM4	47.9N	089.3W	389	24	00.1	14 18	-21.6	07 13	-05.5														
SBIO1	41.7N	082.8W	197	15	00.1	04 06	-15.2	08 08	-04.9														
SGNW3	43.8N	087.7W	242	19	00.1	01 23	-15.8	07 15	-05.1														
SVLS1	31.9N	080.7W								740	31	16.4	19 19	11.3	03 10	13.6							
TPLM2	38.9N	076.4W	098	07	00.1	02 05	-09.8	08 12	-03.1	003	01	10.9	31 23	10.2	31 21	10.5	003	01	-99.9	00 00	-11.2	31 23	-10.8

MARCH	1986		WAVE HEIGHTS (METERS)				FREQUENCY OF WAVE HEIGHTS (%)							
BUOY	LAT	LONG	OBS	MAX	DY HR	MEAN	<1M	1-1.5M	2-2.5M	3-3.5M	4-5.5M	6-7.5M	8-9.5M	>9.5M
32301	10.0N	105.0W	723	3.0	16 02	2.1		10.9	82.9	6.0				
32302	18.0N	085.1W	728	3.5	15 22	1.9		31.5	62.6	5.7				
41002	32.3N	075.3W	126	3.0	28 23	2.0		22.2	74.6	3.1				
41004	32.6N	078.9W	291	3.0	01 17	1.4	5.8	67.6	24.3	2.0				
41006	29.3N	077.3W	737	7.0	22 17	2.2		32.1	48.7	9.2	8.6	1.2		
41007	34.2N	076.5W	764	4.5	14 24	1.7		63.8	23.4	11.7	0.9			
42001	25.9N	089.7W	737	4.0	01 09	1.5	19.3	44.4	23.1	12.2	0.8			
42002	26.0N	093.5W	737	3.5	13 00	1.3	23.8	54.0	16.5	5.5				
42003	26.0N	085.9W	726	4.5	01 13	1.5	15.4	51.5	22.0	8.8	2.2			
42007	30.1N	088.9W	303	2.0	14 04	0.7	57.0	41.5	1.3					
44004	38.5N	070.7W	736	7.5	08 04	2.2	0.1	42.1	36.1	9.5	9.3	2.7		
44005	42.7N	068.3W	596	6.0	07 16	1.9	8.5	40.2	32.0	11.0	7.6	0.1		
44007	43.5N	070.1W	734	3.5	19 17	1.1	29.9	57.4	10.6	1.9				
44008	40.5N	069.5W	735	6.0	07 20	1.8	3.4	56.3	25.0	6.5	8.0	0.6		
46001	56.3N	148.3W	733	6.0	06 06	2.5		15.4	46.6	28.6	9.0	0.2		
46002	42.5N	130.3W	740	8.5	11 08	3.2		2.2	46.0	27.5	16.8	6.7	0.4	
46003	51.9N	155.9W	739	6.5	05 07	2.8		4.8	50.6	28.6	14.8	0.9		
46004	50.9N	135.9W	736	7.0	01 22	3.4			22.1	45.5	30.4	1.9		
46005	46.1N	131.0W	737	7.5	11 07	3.2		0.2	36.9	41.3	17.3	4.0		
46010	46.2N	124.2W	116	2.5	26 01	1.5		64.6	35.3					
46011	34.9N	120.9W	729	7.0	11 14	2.4		38.6	29.6	16.1	12.0	3.4		
46012	37.4N	122.7W	730	6.5	11 12	2.4	0.1	46.1	20.2	13.8	17.8	1.7		
46014	39.2N	124.0W	736	7.5	11 15	2.7		22.8	40.6	14.1	19.6	2.5		
46022	40.8N	124.5W	730	8.0	11 15	2.7		16.1	45.0	17.8	18.0	2.7	0.1	
46023	34.3N	120.7W	725	8.0	16 10	2.5		32.4	36.2	14.0	13.5	3.4	0.2	
46025	33.6N	119.1W	738	4.0	11 14	1.2	22.0	55.4	16.6	5.2	0.4			
46026	37.8N	122.7W	719	6.5	11 19	2.1	1.2	52.9	16.5	16.6	10.2	0.2		
46027	41.8N	124.4W	731	7.0	11 11	2.6		17.6	45.6	20.2	14.9	1.5		
46028	35.8N	121.9W	738	7.0	11 17	2.6		28.0	36.7	17.2	14.6	3.3		
46029	46.2N	124.2W	510	4.0	01 01	2.2		33.7	38.4	25.2	2.5			
46035	57.0N	177.7W	736	8.5	05 14	2.8	2.0	25.0	30.0	20.2	18.2	2.7	1.7	
46125	33.8N	119.1W	247	1.0	21 16	0.8	37.2	62.7						
51001	23.4N	162.3W	040	4.5	02 05	2.9			50.0	35.0	15.0			
51002	17.2N	157.8W	740	4.0	14 10	2.6		6.8	49.1	40.1	3.7			
51003	19.2N	160.8W	739	4.5	05 06	2.5		7.5	58.0	32.4	1.8			
51004	17.5N	152.6W	736	4.0	15 14	2.4		9.3	63.6	26.6	0.1			
51005	20.3N	156.1W	729	3.0	16 02	1.7	1.2	53.9	43.8	0.9				

MARCH	1986		PRESSURE (MB)							WIND SPEEDS (KNOTS)				MEAN WIND SPEED (KNOTS)								
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	MAX	DY HR	DIR	N	NE	E	SE	S	SW	W	NW	TOTAL
32301	10.0N	105.0W	733	31	1015.6	11 06	1007.3	27 23	1011.4	733	09	16 19	080		6.0	6.0	6.1	3.6				06.1
32302	18.0N	085.1W	732	31	1018.0	10 16	1011.3	27 10	1015.1	735	19	31 06	120		6.0	10.7	11.4	8.6				11.2
41001	34.9N	072.9W	636	27	1040.2	25 15	1000.0	06 23	1019.2	637	31	07 01	250	17.2	15.7	10.2	10.6	19.4	15.9	14.1	15.0	15.6
41002	32.3N	075.3W	126	06	1026.5	27 00	1019.6	28 08	1022.7	125	21	28 22	060	5.8	12.0	11.5	10.0	3.1	3.6	3.0	4.6	09.6
41004	32.6N	078.9W	292	12	1031.3	09 04	1008.4	06 20	1018.1	285	27	05 09	280	14.0	12.3	9.0	10.5	12.2	13.6	14.6	12.2	12.9
41006	29.3N	077.3W	740	31	1033.4	25 16	1006.3	01 19	1019.9	739	29	01 22	300	15.3	10.5	12.4	14.0	14.3	12.9	13.3	13.9	13.1
41007	34.2N	076.5W	770	31	1039.1	25 16	1004.1	06 21	1020.9													
42001	25.9N	089.7W	740	31	1032.6	22 16	1004.1	13 23	1018.2	775	29	01 05	320	15.0	11.4	12.0	14.8	13.6	6.7	8.6	13.7	13.1
42002	26.0N	093.5W	739	31	1033.7	22 16	1031.2	12 10	1018.1	738	32	20 07	020	17.1	13.0	11.9	13.1	15.3	8.5	5.6	10.4	13.6
42003	26.0N	085.9W	740	31	1031.6	24 16	1006.9	14 08	1019.2	738	37	01 07	310	18.7	15.0	14.9	17.0	14.5	9.9	9.2	16.4	15.3
42007	30.1N	088.9W	480	21	1031.3	25 17	1004.1	13 00	1018.6	471	33	14 03	120	11.3	9.2	9.1	10.1	9.2	8.6	7.6	9.7	09.5
44004	38.5N	070.7W	740	31	1042.8	25 15	997.0	07 02	1019.5	734	33	07 22	290	15.4	12.8	10.3	7.5	12.8	14.1	16.3	15.9	14.0
44005	42.7N	068.3W	661	31	1040.1	25 12	984.2	07 10	1016.6	674	30	07 15	260	10.2	6.3	12.4	10.4	12.5	13.5	14.3	13.3	12.6
44007	43.5N	070.1W	737	31	1039.6	25 12	986.1	07 11	1017.0	717	31	07 14	270	10.4	12.5	9.7	9.0	14.1	11.9	13.7	11.7	12.2
44008	40.5N	069.5W	739	31	1042.2	25 15	991.8	07 08	1018.2	694	43	15 16	250	11.9	8.2	10.1	10.1	13.9	13.1	16.4	12.8	12.7
44009	38.5N	074.6W	628	27	1041.9	25 15	996.7	15 06	1020.8	605	35	08 02	290	10.6	8.9	5.6	10.4	15.3	11.4	11.5	14.7	12.9
44012	38.8N	074.6W	734	31	1042.1	25 15	995.4	15 07	1020.0	713	35	07 23	300	11.9	10.0	6.7	9.0	14.8	10.3	11.5	15.1	12.4
44013	42.4N	070.8W	740	31	1039.3	25 12	988.6	07 08	1016.9	725	35	19 18	200	11.4	10.6	7.5	9.6	12.3	12.7	14.4	11.6	12.0
46001	56.3N	148.3W	737	31	1024.3	04 22	976.8	09 03	999.8	720	28	30 05	280	12.3	14.1	12.0	10.7	8.9	9.6	14.2	14.2	12.7
46002	42.5N	130.3W	741	31	1031.6	18 21	984.0	10 12	1013.7	738	30	12 19	190	12.6	11.5	11.0	12.1	13.6	12.6	12.6	10.9	12.6
46003	51.9N	155.9W	741	31	1022.5	30 04	978.2	06 15	999.9	740	27	04 23	080	10.0	12.1	15.5	13.6	10.3	13.9	14.1	10.8	12.5
46004	50.9N	135.9W	473	21	1020.5	18 18	978.4	10 11	1004.0													
46005	46.1N	131.0W	737	31	1033.0	30 21	981.8	10 02	1012.2	736	27	09 23	120	11.8	10.7	9.6	15.4	13.0	11.5	12.0	13.1	12.6
46010	46.2N	124.2W	116	06	1023.2	29 08	1014.9	27 11	1018.9	116	21	25 22	180	2.7	2.0	2.0	11.5	12.5	6.5	7.3	4.7	09.7
46011	34.9N	120.9W	732	31	1027.1	21 07	1003.0	16 13	1017.5	701	32	15 18	150	8.1	4.3	3.6	14.7	8.9	6.5	7.0	12.2	10.1
46012	37.4N	122.7W	735	31	1028.0	21 17	998.9	10 11	1017.1	735	36	10 04	160	8.2	4.2	6.8	9.5	13.1	8.4	8.7	11.2	10.6
46014	39.2N	124.0W	737	31	1029.1	21 18	996.8	10 12	1016.9	716	31	10 00	140	9.0	4.3	6.9	15.1	11.8	7.8	8.6	12.4	10.8
46016	63.3N	170.3W	248	31	1041.5	05 00	1000.1	28 00	1015.6													
46017	60.3N	172.3W	225	31	1034.2	04 21	992.8	16 15	1013.0	236	29	01 15	200	13.8	10.9	10.9	14.5	19.6	9.1	6.0	7.7	12.3
46022	40.8N	124.5W	735	31	1030.5	21 19	995.1	10 12	1016.6	712	30	07 09	180	12.3	4.9	4.5	12.5	15.3	10.1	6.8	10.9	11.4
46023	34.3N	120.7W	733	31	1026.7	20 19	1004.5	16 13	1017.8	721	27	10 11	130	9.8	4.2	3.7	9.4	7.9	7.2	8.8	13.7	11.5
46025	33.6N	119.1W	738	31	1025.6	20 18	1006.2	16 13	1016.8	688	27	11 13	280	4.9	4.3	4.9	6.9	5.8	7.0	10.2	7.2	07.6
46026	37.8N	122.7W	730	31	1029.2	21 17	998.1	10 12	1017.9	717	32	10 05	150	5.5	6.4	8.1	15.3	11.5	8.4	8.9	10.8	10.1
46027	41.8N	124.4W	735	31	1031.8	21 19	994.7	08 13	1017.2	654	33	07 11	180	12.0	2.7	2.0	11.6	14.4	7.2	8.8	6.0	09.9
46028	35.8N	121.9W	738	31	1028.1	21 07	1002.0	16 11	1018.1	721	30	10 06	170	9.0	3.2	3.6	7.4	10.8	9.6	8.1	12.7	10.9
46029	46.2N	124.2W	517	22	1030.3	19 06	993.4	10 08	1014.1	507	29	07 12	180	5.7	6.4	10.8	12.0	13.5	11.6	9.4	6.9	10.6
46030	40.4N	124.5W	622	28	1028.2	18 17	995.8	10 12	1015.9	421	39	10 01	130	13.4	7.1	7.6	15.5	12.3	8.1	5.1	15.7	13.0
46035	57.0N	177.7W	740	31	1022.9	25 09	988.8	16 03	1008.8	730	34	05 15	070	17.2	17.5	19.0	16.1	15.2	7.4	7.6	13.3	17.2
51001	23.4N	162.3W	040	02	1016.5	02 08	1010.7	01 02	1013.9	039	17	01 07	330	7.0	1.0				12.2	13.2	13.6	11.2
51002	17.2N	157.8W	740	31	1021.2	07 20	1011.1	04 02	1015.8	733	25	13 22	090	6.1	12.9	15.0	5.8	2.7			4.8	13.8
51003	19.2N	160.8W	739	31	1021.9	07 20	1011.1	04 02	1017.0	735	23	19 16	020	12.0	14.9	12.1	7.7	6.2	4.1	6.8	5.7	13.0
51004	17.5N	152.6W	738	31	1020.7	07 20	1009.6	04 01	1015.1	737	23	13 18	080	9.3	13.8	13.2	7.4	8.5	7.9	7.3	4.2	12.9
51005	20.3N	156.1W	733	31	1021.1	07 20	1009.3	04 02	1015.6	736	27	15 03	050	11.2	17.4	15.6	5.6	5.9	7.8	6.7	1.3	15.6
ALRF1	24.9N	080.6W	740	31	1028.6	24 16	1010.4	01 06	1019.1	682	33	22 08	340	13.8	14.8	17.7	17.1	10.5	6.8	11.0	12.5	14.4
ALSN6	40.5N	073.8W	740	31	1041.1	25 14	990.2	15 09	1018.9	704	43	19 18	220	15.3	9.3	11.9	9.1	10.9	19.8	10.6	18.7	15.5
BURL1	28.9N	089.4W	740	31	1035.6	22 16	1005.5	14 09	1020.3	712	38	14 01	040	11.6	8.3	12.1	15.0	10.0	8.8	7.4	14.0	11.6
BUZM3	41.4N	071.0W	741	31	1041.2	25 14	991.4	07 07	1018.2	724	41	19 18	180	9.2	11.8	10.9	10.1	15.8	15.5	16.3	13.1	14.1
CARO3	43.3N	124.4W	737	31	1031.5	18 17	995.0	10 04	1017.1	697	32	07 11	190	11.5	7.2	3.1	5.5	11.8	14.1	11.2	4.9	09.6
CHLV2	36.9N	075.7W	741	31	1041.1	25 15	1000.2	06 21	1020.4	691	41	08 04	330	15.4	11.9	6.9	11.7	19.1	16.9	18.5	14.0	15.4
CLKN7	34.6N	076.5W	728	31	1039.1	25 15	1003.7	06 21	1020.6	687	28	21 12	020	13.2	11.8	6.2	6.8	11.0	10.2	7.5	9.5	10.4
CSBF1	29.7N	085.4W	737	31	1033.0	23 15	1005.0	14 12	1019.1	697	20	14 13	160	5.3	3.4	5.7	6.4	7.0	7.9	8.6	5.2	06.2
DBLN6	42.6N	079.9W	722	31	1039.3	24 17	990.2	19 11	1017.8	718	45	11 10	230	5.3	5.5	4.6	8.2	6.8	11.5	14.2	8.8	10.0
DESW1	47.7N	124.5W	736	31	1030.2	19 06	990.7	07 13	1015.1	730	35	07 22	170	4.5	6.0	8.0	16.8	15.6	12.5	8.3	9.4	12.8
DISW3	47.1N	090.7W	362	17	1035.6	20 17	998.5	19 06	1015.9	729	35	05 13	040	13.1	14.6	6.7	5.6	6.7	13.2	14.7	12.4	11.8
DSLN7	35.2N	075.3W	774	31	1040.5	25 15	1002.2	06 23	1020.9	634	41	14 22	170	18.2	10.3	9.5	13.4	21.4	18.4	10.4	13.5	16.2
FBIS1	32.7N	079.9W	740	31	1036.2	25 15	1002.9	14 21	1020.1	723	26	19 21	210	7.3	11.4	9.6	6.4	7.6	9.2	4.2	4.0	08.2
FFIA2	57.3N	133.6W	736	31	1024.8	05 05	977.4	08 19	1005.7	603	33	02 00	170	12.0	5.2	4.1	16.1	15.4	17.7	1.7	4.2	12.7
FPSN7	33.5N	077.6W	687	30	1037.8	25 15	1006.1	06 20	1021.0	637	31	20 01	190	15.4	12.2	7.1	12.0	17.1	15.4	10.3	9.3	13.7
GDIL1	29.3N	089.9W	736	31	1035.4	22 15	1003.7	14 04	1019.7	696	34	14 01	090	12.7	9.3	8.6	8.6	6.7	5.5	5.6	8.1	08.6
GLLN6	43.9N	076.4W	738	31	1037.0	24 17	989.4	19 18	1016.2	724	37	11 11	250	6.9	6.2	5.9	9.0	15.7	11.6	15.9	14.0	12.1
IOSN3	42.9N	070.6W	739	31	1038.6	25 12	986.9	07 08	1016.2	718	36	07 14	260	10.8	13.8	9.7	12.9	16.3	14.7	17.1	14.4	14.7
LKWF1	26.6N	080.0W	740	31	1029.7	24 16	1009.6	01 07	1019.3	723	26	15 21	010	12.9	14.0	15.2	15.2	13.1	6.1	5.7	9.0	12.3
MDRM1	44.0N	068.1W	741	31	1040.2	25 14	982.4	07 12	1016.0	716	44	19 20	210	15.2	17.6	15.0	16.7	15.8	18.2	13.3	16.1	16.5
MISM1	43.8N	068.9W	739	31	1040.1	25 13	983.8	07 11	1016.2	714	42	19 16	170	13.1	13.0	15.9	16.1	17.5	15.8	17.7	16.5	16.2
NWPO3	44.6N	124.1W	735	31	1030.7	18 19	993.7	10 05	1016.0	721	38	07 11	190	12.1	4.6	5.0	5.8	12.9	13.4	9.2	9.6	09.4
PILM4	48.2N	088.4W	739	31	1033.9	24 06	995.5	30 07	1014.3	720	35	31 20	130	9.9	12.2	13.0	11.7	12.4	14.0	13.4	15.1	12.8
PTAC1	38.9N	123.7W	740	31	1028.5	21 17	997.1	10 11	1016.7	653	31	10 00	140	9.3	3.5	3.9	9.5	11.2	6.4	11.7	9.0	08.8
PTAT2	27.8N	097.1W	739	31	1035.7	21 16	998.7	11 23	1018.0	709	27	19 10	010	14.0	8.4	9.3	10.7	9.5	5.4	3.7	8.4	10.0
PTGC1	34.6N	120.7W	725	31	1026.1	20 19	1003.3	10 10	1017.1	543	32	10 07	150	12.9	6.7	1.6	15.6	6.2	6.1	4.1	12.6	10.8
ROAM4	47.9N	089.3W	634	28	1033.8	24 05	996.5	30 05	1014.9	608	44	19 12	010	20.4	15.4	12.2	15.0	10.8	17.7	17.0	15.0	15.8
SBIO1	41.7N	082.8W	709	31	1040.5	24 15	991.3	19 09	1018.1	706	32	07 12	310	8.1	3.4	7.6	7.3	13.1	13.9	12.7	14.6	11.6
SGNW3	43.8N	087.7W	740	31	1036.7	24 13	984.7	19 07	1015.4	710	29	08 22	170	10.9	6.8	8.2	9.9	12.8	9.5	9.7	13.2	11.0
SISW1	48.3N	122.9W	734	31	1032.8	08 14	991.9	07 15	1016.6	719	38	07 15	160	3.0	4.6	6.2	12.2	10.5	6.6	9.3	3.3	08.5
SJLF1	30.4N	081.4W	738	31	1034.7	25 15	1007.7	14 22	1020.5	721	27	22 13	030	15.5	11.0	6.3	9.1	9.4	6.6	7.4	3.8	09.0
SPGF1	26.7N	079.0W	741	31	1030.5	24 16	1008.7	01 10	1019.8	732	29	15 22	330	14.3	11.4	12.8	7.6	6.1	5.4	3.6	12.8	10.3
SRST2	29.7N	094.1W	742	31	1030.4	22 16	1002.9	12 04	1019.4	701	24	14 09	290	7.6	6.6	7.1	11.5	8.5	6.2	4.4	8.5	08.8
STDM4	47.2N	087.2W								701	49	19 09	020	18.4	15.6	17.4	14.1	15.4	10.4	16.6	15.5	15.8
SVLS1	31.9N	080.7W	740	31	1035.6	25 16	1006.4	14 17	1020.4	718	34	22 14	010	13.3	15.7	12.1	12.2	13.9	12.9	11.9	14.0	13.0
TPLM2	38.9N	076.4W	737	31	1040.5	25 14	992.6	15 04	1019.2	721	30	08 02	290	9.7	6.4	6.0	10.7	13.4	8.6	10.4	11.4	10.8
TTIW1	48.4N	124.7W	736	31	1031.3	04 18	989.9	07 15	1015.8	734	40	07 15	190	5.5	11.7	16.9	10.9	18.0	14.2	12.5	4.5	14.8
WPOW1	47.7N	122.4W	736	31	1030.9	19 09	993.6	07 14	1016.5	704	30	07 16	190	6.5	4.5	3.1	6.1	10.1	9.1	2.6	2.6	07.6

MARCH 1986			TOTAL FREQUENCY OF WIND SPEEDS (%)							TOTAL FREQUENCY OF WIND DIRECTIONS (%)							
BUOY	LAT	LONG	CALM	<4KT	4-10KT	11-21KT	22-33KT	34-47KT	>47KT	N	NE	E	SE	S	SW	W	NW
32301	10.0N	105.0W		0.4	99.6						0.2	43.9	55.7	0.2			
32302	18.0N	085.1W	0.5	0.1	45.7	54.1					0.2	20.3	77.2	2.3			
41001	34.9N	072.9W		2.0	21.7	53.2	23.1			20.4	5.8	4.9	8.4	16.5	12.3	12.9	18.6
41002	32.3N	075.3W		13.6	33.6	52.8				13.4	49.8	19.6	0.6	3.8	3.4	6.2	3.2
41004	32.6N	078.9W	1.1	1.8	37.5	56.5	4.2			9.0	10.1	3.1	6.2	8.9	30.1	14.0	16.6
41006	29.3N	077.3W		0.7	31.5	62.2	5.5			12.3	19.9	11.3	11.3	14.6	8.6	10.7	11.3
42001	25.9N	089.7W		4.8	29.9	55.1	10.2			18.2	20.5	20.1	12.7	17.4	3.4	1.6	6.1
42002	26.0N	093.5W		4.2	29.1	53.7	13.0			17.2	17.6	26.6	20.3	15.1	1.2	0.5	1.5
42003	26.0N	085.9W		6.9	15.7	63.3	13.7	0.4		13.8	27.9	11.8	10.9	17.6	5.6	3.3	9.1
42007	30.1N	088.9W		8.7	55.6	32.3	3.4			8.9	7.2	12.5	25.6	16.3	11.1	8.9	9.4
44004	38.5N	070.7W		4.9	27.5	54.0	13.6			18.6	9.5	6.2	6.7	16.1	10.9	14.3	17.7
44005	42.7N	068.3W		7.9	34.6	46.4	11.1			10.5	2.6	5.0	9.5	14.9	22.0	15.5	20.1
44007	43.5N	070.1W	4.0	6.0	38.9	46.9	8.2			10.5	5.2	6.3	4.4	19.2	20.1	14.9	19.5
44008	40.5N	069.5W	3.0	5.5	38.8	44.4	11.0	0.4		11.8	10.7	7.5	2.3	20.7	17.1	14.7	15.1
44009	38.5N	074.6W	2.0	6.4	36.7	45.8	10.7	0.3		10.1	7.2	2.7	11.3	34.5	8.1	6.7	19.3
44012	38.8N	074.6W	3.1	4.8	42.5	40.7	11.9	0.1		12.1	8.6	6.3	9.6	30.9	6.7	8.6	17.2
44013	42.4N	070.8W	3.3	6.8	39.6	45.8	7.7	0.1		5.5	2.6	4.0	13.4	16.3	20.4	19.3	18.5
46001	56.3N	148.3W		6.1	33.8	50.6	9.6			6.9	20.4	8.5	4.9	7.5	13.4	28.3	10.1
46002	42.5N	130.3W		3.3	29.7	64.0	3.1			11.0	4.9	3.5	10.0	27.1	19.6	16.6	7.3
46003	51.9N	155.9W		4.1	38.2	49.1	8.6			13.2	13.3	12.5	9.1	7.1	8.8	15.6	20.4
46005	46.1N	131.0W		2.6	29.2	65.1	3.1			2.4	1.3	3.4	16.7	27.4	34.3	8.7	5.8
46010	46.2N	124.2W	2.6	6.0	52.6	41.4				8.4	0.9	0.9	2.4	60.8	12.7	3.4	10.6
46011	34.9N	120.9W		15.0	37.4	43.7	4.0			15.0	4.9	2.5	8.1	8.1	4.2	9.7	47.4
46012	37.4N	122.7W		9.4	45.6	39.3	5.4	0.3		9.8	1.0	1.9	6.6	17.3	6.6	8.4	48.4
46014	39.2N	124.0W		10.6	45.5	35.5	8.4			24.7	3.1	5.3	12.7	14.1	4.0	7.4	28.7
46017	60.3N	172.3W	1.3	6.8	35.6	48.3	9.3			35.4	37.8	12.1	4.4	3.7	3.1	0.6	2.9
46022	40.8N	124.5W		14.2	35.8	41.2	8.8			30.7	6.1	3.9	13.6	19.1	10.8	7.6	8.3
46023	34.3N	120.7W		9.8	33.6	53.4	3.2			11.0	2.9	2.2	8.2	6.4	4.9	4.9	59.5
46025	33.6N	119.1W		26.0	50.6	21.1	2.3			5.5	3.4	6.4	8.4	11.6	10.6	31.6	22.5
46026	37.8N	122.7W		12.3	41.8	42.7	3.2			1.8	2.8	5.3	4.9	14.6	9.0	24.1	37.2
46027	41.8N	124.4W	23.5	17.7	36.2	34.6	11.5			17.4	1.3	10.8	22.9	20.6	12.9	3.9	10.2
46028	35.8N	121.9W		10.5	35.5	49.9	4.0			9.1	1.6	2.9	7.1	10.0	4.7	7.0	57.6
46029	46.2N	124.2W	3.7	5.5	48.5	44.6	1.4			6.5	7.7	18.9	5.1	29.0	15.9	6.9	8.0
46030	40.4N	124.5W	5.0	9.7	30.6	46.8	12.1	0.7		20.0	2.6	3.3	36.4	12.5	8.8	5.4	11.0
46035	57.0N	177.7W		2.2	15.3	54.2	28.1	0.1		12.3	31.4	31.5	12.4	5.5	1.3	1.9	3.6
51001	23.4N	162.3W		12.8	15.4	71.8				29.5	2.6				3.8	14.1	50.0
51002	17.2N	157.8W		3.8	17.3	76.4	2.5			5.3	22.8	69.3	1.9	0.3			0.4
51003	19.2N	160.8W		2.6	26.8	69.4	1.2			7.8	64.1	12.4	4.2	4.7	2.2	2.9	1.7
51004	17.5N	152.6W		1.2	23.9	74.6	0.3			1.4	38.4	51.6	5.7	1.3	0.8	0.3	0.4
51005	20.3N	156.1W	1.8	2.3	18.1	67.5	12.1			0.8	72.6	12.1	0.3	3.0	6.1	4.0	1.1
ALRF1	24.9N	080.6W	0.7	3.5	28.3	52.1	16.1			15.2	17.0	18.4	18.4	9.1	4.5	6.0	11.4
ALSN6	40.5N	073.8W	2.4	6.1	26.1	44.6	17.8	5.4		15.4	5.5	8.5	5.4	6.9	28.9	10.2	19.2
BURL1	28.9N	089.4W	2.5	11.2	41.0	35.7	11.9	0.1		17.0	18.1	15.5	16.1	6.6	6.4	3.3	17.1
BUZM3	41.4N	071.0W	4.4	7.6	27.2	48.8	13.7	2.8		7.2	7.1	4.1	6.5	20.8	22.3	16.9	15.0
CARO3	43.3N	124.4W	2.9	15.5	47.6	29.7	7.2			15.8	13.4	4.8	19.3	25.8	14.7	3.7	2.5
CHLV2	36.9N	075.7W	0.7	4.2	25.2	49.8	19.5	1.3		18.4	11.2	6.4	6.4	27.4	15.3	3.8	11.1
CLKN7	34.6N	076.5W	1.6	6.7	50.7	38.7	3.9			15.2	23.5	7.5	8.2	14.5	20.3	9.1	4.6
CSBF1	29.7N	085.4W	4.0	24.2	62.4	13.3				14.7	8.5	18.1	14.5	9.4	10.7	11.5	12.6
DBLN6	42.6N	079.4W	3.9	14.9	46.1	30.8	7.8	0.4		1.6	8.7	4.6	4.8	13.9	46.1	15.0	5.4
DESW1	47.7N	124.5W	3.2	10.0	34.4	42.9	12.5	0.3		2.3	7.9	7.0	34.6	16.7	10.2	5.0	16.4
DISW3	47.1N	090.7W	2.6	9.7	42.5	34.7	12.8	0.3		8.1	20.8	4.6	5.1	15.8	24.5	7.3	13.7
DSLN7	35.2N	075.3W	2.1	5.7	21.8	44.6	24.1	3.8		26.3	8.3	2.5	6.3	14.5	22.8	12.7	6.5
FBIS1	32.7N	079.9W	2.2	20.5	48.7	29.6	1.2			8.4	17.0	16.2	7.3	10.1	22.3	9.4	9.3
FFIA2	57.3N	133.6W	5.6	12.1	30.2	45.3	12.4			27.2	10.8	3.6	35.5	14.9	2.7	0.6	4.7
FPSN7	33.5N	077.6W	2.0	6.0	28.6	49.9	15.5			21.2	18.8	4.3	5.0	16.0	18.7	11.0	5.0
GDIL1	29.3N	089.9W	4.3	16.2	55.5	25.0	3.2	0.1		14.5	11.0	20.9	21.2	10.2	10.6	3.4	8.2
GLLN6	43.9N	076.4W	2.6	10.1	37.6	40.7	11.2	0.4		6.2	13.5	7.5	4.8	19.9	12.9	24.3	10.8
IOSN3	42.9N	070.6W	1.4	6.3	26.7	45.8	20.2	1.0		7.1	5.5	4.1	9.9	22.6	16.1	18.6	16.2
LKWF1	26.6N	080.0W	0.3	4.3	33.3	57.5	4.8			6.4	18.0	16.0	14.9	15.4	4.7	7.8	16.7
MDRM1	44.0N	068.1W	1.5	4.5	22.2	43.7	27.0	2.7		8.9	4.9	10.0	5.1	15.9	22.1	11.5	21.6
MISM1	43.8N	068.9W		4.3	26.6	39.4	27.2	2.5		6.3	7.8	7.8	4.7	20.5	21.4	13.0	18.5
NWPO3	44.6N	124.1W	1.0	15.1	47.9	33.3	3.6	0.1		7.9	6.7	21.9	10.7	20.4	14.9	6.6	10.9
PILM4	48.2N	088.4W	1.3	6.7	33.9	49.4	9.9	0.1		12.3	14.7	9.5	6.5	14.4	16.3	14.2	12.2
PTAC1	38.9N	123.7W	7.7	15.9	47.3	34.2	2.6			33.9	11.1	4.7	13.7	21.6	4.1	4.1	6.9
PTAT2	27.8N	097.1W	1.1	5.2	49.5	44.4	0.8			8.7	7.4	26.2	42.4	8.5	2.4	1.2	3.2
PTGC1	34.6N	120.7W	6.3	15.7	36.5	40.0	7.9			44.0	4.2	0.9	6.1	23.0	2.2	2.4	15.2
ROAM4	47.9N	089.3W	1.2	3.9	21.5	50.0	23.4	1.2		9.9	22.9	9.3	5.8	8.3	19.7	14.7	9.4
SBIO1	41.7N	082.8W	2.7	7.9	40.9	42.6	8.5			6.8	3.3	10.8	9.6	10.9	26.4	18.3	13.9
SGNW3	43.8N	087.7W	2.7	8.5	44.5	40.1	6.9			8.4	6.9	4.4	5.8	27.2	16.0	13.3	18.0
SISW1	48.3N	122.9W	7.4	21.4	47.1	25.6	5.7	0.1		4.5	4.7	8.7	25.6	15.7	8.9	20.9	11.1
SJLF1	30.4N	081.4W	1.5	9.0	57.1	32.9	1.0			9.9	19.8	6.8	12.9	13.4	12.4	12.8	12.0
SPGF1	26.7N	079.0W	2.2	8.9	46.2	40.8	4.1			6.4	12.6	27.3	18.5	12.0	7.5	2.7	15.9
SRST2	29.7N	094.1W	2.0	6.1	57.6	33.4	0.9			10.1	5.6	4.2	31.9	32.6	6.9	2.9	5.8
STDM4	47.2N	087.2W	1.1	4.3	20.3	56.6	16.3	2.4	0.1	19.2	4.3	12.8	9.4	15.9	11.3	15.7	8.2
SVLS1	31.9N	080.7W	1.7	3.2	27.7	60.9	8.1	0.1		11.8	17.5	11.3	13.1	17.0	11.0	7.8	10.2
TPLM2	38.9N	076.4W	3.3	10.5	41.4	41.6	6.2			9.2	6.1	4.2	11.8	26.3	5.7	11.3	23.4
TTIW1	48.4N	124.7W	2.5	9.0	25.6	40.7	23.4	1.2		0.2	7.2	31.0	13.7	18.3	16.4	11.7	1.2
WPOW1	47.7N	122.4W	6.1	24.6	49.1	25.1	1.1			13.9	19.7	2.6	11.5	44.2	6.1	1.0	0.9

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